COMMITTEE HEARING

BEFORE THE

ENERGY RESOURCES CONSERVATION AND DEVELOPMENT

COMMISSION OF THE STATE OF CALIFORNIA

In the matter of,	)	
	)	Docket No. 14-BSTD-01
	)	
2016 Buildings Energy Efficiency Standards	)	

CALIFORNIA ENERGY COMMISSION

HEARING ROOM B

1516 NINTH STREET

SACRAMENTO, CALIFORNIA

TUESDAY, JUNE 24, 2014

9:00 A.M.

Reported By:

Peter Petty

APPEARANCES

CEC Staff Present

Mazi Shirakh

Adrian Ownby

Simon Lee

Consultants Present

James Benya

Michael McGaraghan, Energy Solutions

David Douglass-Jaimes, TRC (Via Telephone)

Michael Mutmansky, TRC

Jon McHugh, McHugh Energy

Also Present

Public Comment

Keith Cook, Philips

Mike Hodgson, Con-Sol, CBIA

Robert Raymer, CBIA

Lorne A. Whitehead, UBC

Cheryl English, Acuity Brands

Al Safarikas, CREE

Noah Horowitz, NRDC

Alex Boesenberg, NEMA

Mark Lien, Osram Sylvania

David Wilds Patton, DWP Lighting Design

George Nesbitt (Via Telephone)

APPEARANCES (CONT.)

Also Present

Public Comment

Owen Howlett, SMUD (Via Telephone)

John Martin, IALD

Richard Haring, Philips

Michael Jouaneh, Lutron

Gary Flamm

Rebecca Rainer, Eaton Cooper

INDEX

P R O C E E D I N G S

JUNE 26, 2014 9:00 A.M.

MR. SHIRAKH: Okay, we're ready. I'm Mazi Shirakh. We're going to start the workshop.

This is the second workshop of the 2016 Standards. Today's topics are exclusively lighting, res and nonres. So, if you're here for anything other than lighting, you're probably in the wrong place.

A couple of housekeeping notes. The restrooms are outside to the left. The cafeteria is upstairs on the second floor.

If there's an emergency, we're going to follow the crowd out the building, across the street in the park, and then you'll have further instructions.

I want to introduce a few of my colleagues who are up here. Mike McGaraghan, you know, he's going to start the res lighting presentation.

Jim Benya, to my right, he's a Commission consulting on lighting.

And Simon Lee is the Commission's lighting lead on lighting for both res and nonres.

And I'm Mazi Shirakh. I'm the Project Manager for the 2016 standards.

So with that I have a brief presentation. But before we get to that we are transcribing today's --

it's being recorded and it will be transcribed. So, when you come up to the podium for comments, or anytime during the day please introduce yourself, and your affiliation. Better yet, you can give the court reporter a business card. That will make his life easier.

And there is a sign-in sheet outside the door. You can either write your name and contact information, or staple a business card to it.

So with that, we're going to get started; next, please.

So, this is a brief presentation. It shouldn't take more than a few minutes. We're going to talk about the Commission's authority to adopt standards and update them, the 2016 Standards update schedule, the standards update process.

And I'll talk briefly about lifecycle costing and time-dependent valuation.

Next, so the authority to adopt and update the standards was giving to the Commission in 1974. The law was signed by then Governor Reagan.

The first standards were adopted in 1978 and it's being updated every three to four years ever since.

The standards are required to be cost effective. I'll talk about that in a little bit more detail later.

The standards include mandatory and prescriptive measures, and they also provide an alternative path through the performance approach.

The standards are developed in an open and public process.

The next, please; the policy drivers for the Building Standards are the Governor's Clean Energy Job Plan, the Zero Net Energy for Residential Units by 2020, and Nonresidential by 2030, California Air Resources Board's Climate Change Scoping Plan, and California's Long-term Energy Efficiency Strategic Plan.

The next, please; more efficient buildings will create greener jobs in California, higher paying jobs. It will result in investments by entrepreneurs and will make California globally more competitive.

The next, please; goals for the standards for new buildings to establish a plan and timeline to make new homes and commercial buildings to meet the zero net energy targets, making the building envelope and other systems within the buildings as energy efficient as possible, and then using renewables to make ZNE possible.

And the benchmark for ZNE is the 2008 Standards. So, the 2008 Standards will basically -- will have an EUI of 100 and then zero net energy is going to be zero.

So, you know, we've already had 2013 Standards that have been adopted, so that moves the Energy Use Index lower than 2000, and then with the 2016 and 2019 Standards the EUI will be further reduced. I'll show that in the graph a little bit later.

The next, please; for those of you who were around the 2013 Standards, this was an open and public process. We convened about 45 stakeholder meetings, which were sponsored by the California's investor-owned utilities throughout the State, some of them in person, some of them webinars.

And then we also held 15 staff workshops here at the Commission. And we responded to several thousand comments. You know, we logged them and responded to all of them.

The 2016 Standards, by comparison, is much more abbreviated than the 2013.

The next, please; so this is the graph that defines the ZNE target. You know, starting back in the 70s the units I think are, if I can read them, Btu per square foot per year.

We started at a level that was over 100, probably 110 Btu's per square foot, per year for our buildings.

This is back when you hardly had maybe R-9 in

the walls, maybe R-19 if you were lucky, in the ceilings.

You probably had single-pane aluminum windows that had mildew grow all over them in the wintertime, with probably a U factor of 1.2 or something, ducts leaking and so on, and so forth.

So through the years, with the 2014 Standards, which should be 2013, we've been able to reduce that to around 22 from 120, so that's a significant reduction.

Our goal is to pretty much bring it down to around 10 or 12 Btu's per square foot, per year. So, you know, we're very close but we're not quite there. But that is the target for ZNE.

And these are only the regulated loads in the building. We're not talking about plug loads and some of the other appliances, which is outside of our control for Title 24.

The next, please; this is the schedule for the 2016 update. It started out on April 4th of this year at SMUD, with the CBIA/CEC kickoff meeting.

In May of 2014 IOUs held several stakeholder meetings, one in person, the rest of them webinars. And they presented most of these topics, actually, all of them.

During those meetings with the public they got

lots of feedback and those comments have been incorporated in the presentations. So, the presentations reflect the results of those comments.

And as a result of that they gave us a bunch of presentations and case reports, which has become the basis for the staff workshops of this month. We had one earlier in the month, on the 12th. And, you know, this is the second one and we'll have several others coming up through August of this year.

In November of 2014 we will present our draft standards, which basically will be the result of all the stakeholder meetings, these workshops, and all the comments we'll get in person, and through future webinars, e-mails and so forth.

And so, the result of that will be the draft standards which we'll present to the public in November.

And then, that will become the basis for the 45-day language, which will be released in January of 2015.

And then, in all likelihood, we're going to have a 15-day language, which will be released in April of 2015.

And adoption for May of 2015, effective date will be January 1, 2017.

The next, please; so this is the schedule for the staff workshop. You know, we've already had the

June 12th. We're at today's June 24th, which is all the residential lighting. I can't read those dates.

July 21st -- I'm sorry July 9th is going to be our TDV workshop and lifecycle costing. This will be a workshop that's going to be led by the Lead Commission McAllister.

And, you know, after that workshop we should have all of our TDV numbers, and factors, and multipliers in place for 2016.

July 21st is all residential topics, will include the high-performance attics, high-performance walls, tankless water heaters and residential HVAC fault detection and diagnosis measures.

July 23rd will be the workshop on residential and nonresidential ACM manuals, and we'll also be talking about some residential compliance credits, like the photovoltaic credit and the whole-house fan credit.

And August 6th will be the CalGreen workshop.

The next, please; standards updates includes the following phases, the pre-rulemaking, which is where we are now, the first part of that was the stakeholder meetings which was concluded last month by the IOUs.

We're in step two of that, the staff workshops, which will conclude in August.

Then the formal rulemaking will start with the

release of the 45-day language in January and the 15-day language. And adoption at Business Meetings are all part of the formal rulemaking process.

The next, please; the pre-rulemaking was sponsored by the utilities in California, in particular the investor-owned utilities, PG&E, Edison, Southern California Gas, and San Diego Gas and Electric.

We also got assistance from SMUD and LADWP. They held meetings throughout the State. There was at least one stakeholder meeting for every single one of these topics that we're presenting today and in the future.

And they seek comments from the public, which has been incorporated. And they submitted those presentations and reports, which is the basis of today's workshop.

The next, please; and so this is the second phase of the pre-rulemaking staff workshops which, you know, most of you are familiar with. It's being held in the Commission, here, and we'll consider your comments as we move forward.

The next, please; and the rulemaking will start in January and that will be presided by the Commissioners. And the adoption Business Meeting will be attended by the entire Energy Commission.

The next, please; so the law requires that the standards as a whole must be cost effective. And we've set the precedence that not only standards as a whole must be cost effective, each individual measure must also be cost effective.

And for that we use lifecycle costing methodology, which is basically a net present value model that we use. We look at the stream of revenues, benefits, costs, both maintenance, energy projected into the future, and we bring them back into a present value.

And we use discounted cash flow and discount rates. The life of the measures are 30 years for residential measures. For nonresidential it's 30 years for envelope measures and 15 years for lighting and HVAC.

So, today's topics, lighting measures, typically fall under the 15-year lifecycle costing methodology.

And, you know, if there's a measure that doesn't last for the entire 30 years or the 15 years, we assume replacement cost for them and then you discount that back into the future, too, along with all the other costs and benefits.

What gets plugged into lifecycle costing is time dependent value, TDV, which is a way of accounting for the variable value of energy, a unit of energy that is

produced and transmitted, and distributed on a hot summer afternoon costs more than an off-peak unit of energy that's done at midnight, or perhaps in the winter.

So, to account for that we have a TDV multiplier for every hour of the year, 8760 TDV multipliers, and that's applied to the value of energy to account for this variable.

And the result is that measures that save energy on-peak, during congestion and high-peak demands are viewed more favorably under TDV than measures that save energy off-peak.

The next; so that's it. Any questions? Online any questions?

And, again, this is also being webcasted. So, we ask you to come to the podium for your comments so people online can also hear.

So, if there are no questions, I'm going to turn it over to the team to present their residential lighting.

This schedule here has times attached to it, but I can assure you these times are very approximate and we'll probably deviate from them.

So, if you're interested in a topic, you need to monitor that all day. I cannot guarantee that, you

know, these times will be adhered to. In fact, it's probably likely we're going to be out of here before five o'clock.

So with that, we'll start the workshop. Thank you.

MR. OWNBY: Quickly, did Maxi cover that in the event of an emergency you'll be following staff through the probably the doors to your left, as you exit, and we'll reconvene over at Roosevelt Park, which is to the -- well, it's caddie corner to this building, so you'll follow Mazi and he'll find it for you.

Also, there are restrooms, if you're not familiar with the building there's restrooms out the door to your left, and there's a snack bar upstairs, if you need some snacks.

MR. MC GARAGHAN: Okay, should I get started, Mazi?

MR. SHIRAKH: Yes.

MR. MC GARAGHAN: So, as we're pulling up the slides here I'll just give a quick introduction. We are going to be presenting the topics today on behalf of the Investor-Owned Utilities' Statewide Codes and Standards Team. There are a number of different people working on all of the proposals so we'll be bouncing around between presenters.

But starting with residential lighting this morning, David Douglass-Jaimes from TRC is the primary case author on this measure, and he's actually on the phone remote, so he's going to start off for a chunk of these slides.

And then my name is Mike McGaraghan, from Energy Solutions, and I'll take over for a section of the presentation in the middle.

So David, if you're online and if we can hear you, I think take it away.

MR. OWNBY: Just a moment, I'll have to unmute him, yeah. Okay, it looks like, David, you're unmuted. Now, I'm going to go ahead and turn over the presentation rights to you.

MR. DOUGLASS-JAIMES: Great. Good morning, can everyone hear me?

MR. MC GARAGHAN: Yep.

MR. DOUGLASS-JAIMES: Great. So, do I need to -- I'm sorry, do I need to share my desktop or --

MR. OWNBY: Yes, you will, you'll need to share your desktop.

MR. DOUGLASS-JAIMES: Okay, great, hang on one second.

All right, hopefully everyone can see my screen.

MR. OWNBY: Yeah, it looks good, David.

MR. DOUGLASS-JAIMES: Great. Thanks everybody. As Mike mentioned, I'm David Douglass-Jaimes from TRC. And we'll try to go through all of this fairly quickly. I know we have a lot of information to present and I'm sure there will be a lot of questions, so I'll just sort of jump right in.

First, we wanted to give a background to everyone sort of on the current code requirements for residential lighting, just to sort of set the scene for our proposal.

Currently, all fixtures in residential, all permanently installed fixtures in residential lighting are categorized as either high-efficacy or low-efficacy. And this table here sort of briefly summarizes what is in the standards as Table 150.0-A.

So, you can see things that are classified as high-efficacy are typically linear or compact fluorescents, high-intensity, HID sources, any GU-24 sockets, LED sources that have been certified through the Commission, and induction.

And low-efficacy is pretty much everything else, including anything that is incandescent or even high-efficacy lamps that are installed in low-efficacy luminaires, track lighting and any LED sources not certified to the Commission.

And these categorizations of high-efficacy versus low-efficacy inform the other sort of room type requirements, which are summarized on this slide.

And as you can see or if you're familiar with the residential lighting requirements, there's a lot of different room type requirements. They get a little complicated in kitchens. At least 50 percent of the lighting wattage must be high-efficacy, which requires a calculation of luminaire wattage and labeling.

And there's also an additional allowance for 50 watts of low-efficacy lighting or 100 watts of low-efficacy lighting depending on your house size.

There's another calculation involved if you want to do internally-illuminated cabinets.

And then in bathrooms at least one fixture must be high-efficacy and all other fixtures must be high-efficacy or controlled by vacancy sensors.

Garages, laundry, utility rooms must be all high-efficacy and controlled by vacancy sensors.

And in any other room permanently installed lighting must be high-efficacy or controlled by a dimmer or a vacancy sensor.

So, there's a lot of different requirements going on depending on the room type, a lot of options to consider.

And what we've found looking at typical residential lighting practice is that even though high-efficacy lighting has been cost effective and included in the standards since 2005, adoption of high-efficacy lighting is still relatively low.

As you can see from the chart on the right there, 79 percent of all lighting watts installed in residential lighting, according to a 2011 study, is still incandescent. And an additional two percent is halogen.

So, 81 percent of lighting watts are still low-efficacy.

And the energy savings that we receive from low-efficacy lighting, combined with controls, is far less than the savings that we could be achieving if we had more high-efficacy lighting.

Oh, yeah, and so the current standards that we're working on is the 2013 standards, which have yet to go into effect, yet. Or, I guess, they'll go into effect in a few days.

So, there's a little bit of a gap here.

And so, we've sort of estimated typical practice, what typical practice would be under the 2013 standards based on what we've seen previously and how the 2013 standards changed the standards.

And as I mentioned, 81 percent of all installed watts are low-efficacy. Although that equates to only 62 percent of the installed lamps, but as I mentioned the definition of high-efficacy versus low-efficacy is actually made at the fixture level.

And so, 70 percent of sockets in residential new construction are considered low-efficacy regardless of the type of lamp that they have in them.

But about eight percent of those sockets are eventually installed with high-efficacy screw-in lamps, such as CFL.

So, one of the things that we wanted to address is the barriers that there have been in the past to high-efficacy lighting.

One of the key barriers there is the quality of high-efficacy light sources. Color quality as well as other quality issues, are common complaints for CFL light sources.

There's also been limited availability of high-efficacy fixture choices that comply with the requirements in the code.

I think there's also some confusion in terms of the high-efficacy luminaires. GU-24 and pin-based CFLs are less familiar to consumers. And integral LED luminaires leave sort of little flexibility or options

later, if consumers want to change their light sources.

And there have also been higher costs for the currently defined high-efficacy luminaires.

So, luminaires that are either, you know, integral high-efficacy luminaires or GU-24-based luminaires tend to have higher costs than other options that would qualify as low-efficacy in the current standards.

But we are also seeing that there are some new opportunities for high-efficacy lighting. First of all, new high-quality, high-efficacy LED sources that are providing higher color renderings closer to incandescent, as well as color temperatures that are closer to incandescent.

And incredibly long life for residential applications, this says ten plus years. But what we know is if LEDs are meeting their life projections, they could last for the life of a home in residential applications because of the low hours of use.

And there's also rapidly decreasing costs in the LED market.

There's also the impending Federal and State Lamp Standards, which will be phasing out most traditional low-efficacy lamp sources.

And these are scheduled to go into effect in

California earlier than in the rest of the country, starting in 2018.

So, moving into our proposal for the Residential Lighting Standards, in general the goal is to simplify the Residential Lighting Standards greatly, and increase the use of high-efficacy lighting.

And so, what we propose is to require high-efficacy lighting in all room types. And we would basically eliminate the allowances for low-efficacy lighting that are now associated with controls requirements.

And to balance that out we would also relax the definition of what constitutes high-efficacy lighting.

We wouldn't change any of the existing high-efficacy definitions. So, anything that's already considered high-efficacy in Table 150-A remains, so any GU-24 or other hard-wired, high-efficacy sources are still considered high-efficacy.

But we would also allow any type of fixture that is installed with a high-quality, high-efficacy source that complies with the revised JA8 appendix requirements.

So, this means that any screw-based or any other fixture type socket could comply with the high-efficacy requirements as long as the source that is installed,

the lamp that is installed at the time of inspection complies with JA8.

The one exception to that would be recessed down lights, where we propose to require either a JA8-compliant dedicate luminaire, or quick-connect, or Zhaga-based luminaires.

And we also are proposing to maintain the existing control requirements so -- or maintain consistency with the existing control requirements.

So, at least one luminaire in bathrooms, laundry rooms, utility rooms and garages must be controlled by vacancy sensors.

And dimmers or vacancy sensors would be required for any screw-based fixtures or other fixtures that are using -- that would otherwise be -- not quality as high-efficacy unless they had the JA8 compliance source in all room types, other than kitchens, bathrooms, laundry rooms, utilities and garages.

So, this is pretty consistent with the existing control requirements that are in the 2013 standards.

So, as far as energy savings goes, under current practice the average house has about 1600 watts of low-efficacy lighting and the average hours of use for residential light sources is about 1.7 hours per day, or 621 hours per year, which works out to about 988 kWh per

year for the average house just from low-efficacy lighting.

And the potential energy savings that we are predicting from the proposed revisions to the standards is about 625 kWh per year, per average home.

And that's assuming a pretty significant, 73 percent savings from the down light requirements and then 60 percent savings from switching all other lighting from low- to high-efficacy sources.

As far as cost effectiveness goes, there's about 15.9 average down lights in typical new construction, as well as 21 low-efficacy sockets that are not down lights.

And so, our assumptions, using cost projections for 2017 when these standards go into effect, the incremental construction costs we predict to be about $525 per home.

And that takes into account the savings -- some savings that you get, as well, from the LED dedicated down lights that have integral trim rings, et cetera

And then, in terms of maintenance cost it's actually a savings over the 30-year life of the measure since this is residential.

On average the LEDs would need to be replaced in the 24th year, so that's a pretty long lamp life.

And so, the present value of those maintenance costs is $258, whereas replacing traditional incandescent life sources over the life of the measure would be about $390. So, that's a savings in maintenance cost.

So, as I mentioned, the total incremental cost is about $365, whereas the energy and maintenance savings works out to about $2,396 per home.

So, the benefit-to-cost ratio is about 6.5, which is pretty good.

So, just to summarize here, you know, this proposed co-change, it's relatively affordable and provides high-quality, high-efficacy lighting.

As I mentioned, the incremental construction cost is about $365, using projected 2017 costs.

By comparison, installing all hard-wired LED fixtures, using the 2013 standards can cost anywhere from -- has an incremental cost of anywhere from $2,300 to $4,400 based on findings from a recent program that's trying to install all high-quality LED sources.

And the LED costs are, you know, projected to continue to decrease moving into the future.

And for the most part this -- the proposed change will also provide a little bit more fixture and lamp choice flexibility for consumers, allowing the

screw-based fixtures to qualify as high-efficacy as long as they have these high quality, JA8-compliant sources installed.

So, at this point I'm going to hand it over to Mike McGaraghan to talk about some of the lighting quality issues.

Mike, do you want me to just continue to advance the slides while you present?

MR. MC GARAGHAN: I was going to -- I'll go ahead and take the presentation rights back and hand them back to you in just a second.

MR. DOUGLASS-JAIMES: Okay.

MR. OWNBY: I believe we were on slide 12.

MR. MC GARAGHAN: There we are.

MR. OWNBY: Yeah.

MR. DOUGLASS-JAIMES: Yeah.

MR. MC GARAGHAN: Great. All right, thanks David.

So, I'm going to run through the next section of the presentation which is going to focus on the quality metrics that are being proposed for these new screw-based high-efficacy sources.

Starting with a little bit of background about how we got going down this path. I think I spent 20 or 30 minutes on this section in the meeting on May 15th,

and today is going to be abbreviated. I think most of the people here were also at that May 15th meeting.

So, we've taken out some slides to move a little quickly.

The other reason I want to do that is because there are a lot of people who have traveled a long way to be at today's meeting and I want to make sure we save time for everyone's comments.

We've worked a lot with a number of you that are here, a number of stakeholders, including manufacturers, and designers, and the academic community.

So, in particular, I'm excited to hear some comments from various stakeholders about quality and why it's important, and why we need to focus on it.

So, we'll move forward fairly quickly.

So, just at the high level; why the focus on quality?

Most of this is in response to the CFL market and what happened there in trying to improve, and not repeat mistakes.

So, this graph shows CFL prices versus CFL market share over about a 30-year period. And as CFL prices started to come down below $10 and $5, finally we saw an uptick in market share.

And that was a very exciting accomplishment for

the lighting community, the energy-efficiency community. There was a lot of energy saved.

But then you see a plateau there around 20 percent sales. If you consider sockets, it's probably higher, maybe 30 or 40 percent.

But it pointed out that there was more to it than just bringing down the price. So, with newer, high-efficacy sources we're looking into what else should be done in addition to bringing down product prices.

The next slide; there are a lot of people that have been studying the CFL issue and trying to figure out what happened. And the consensus or one of the themes that comes through is that a lot of people didn't like CFLs, at least not enough to install them in all their sockets.

So, three themes in particular jumped out from a lot of studies that have been done in CFLs. One is that CFLs aren't compatible, either with existing sockets, they don't fit, or they're not compatible with dimmers.

Another theme is light quality. You hear it time and time again, CFLs have poor light quality, harsh, cold, or unfriendly light.

And even though they've improved over the years and today I think most of us in this room would agree

that there are some great CFLs out there, CFLs got a bad rap for having poor light.

And then the last theme there is performance. They don't live up to long-life claims, or they buzz, or flicker, slow start time, et cetera, et cetera.

So, next slide; looking at the question from the other angle, what is it that consumers do care about?

This was a study that McKinsey did a couple of years ago, over 600 lighting professionals and over 1,000 consumers and tried to identify what elements or what aspects of lighting were most important in purchase decisions.

And you can see the red box there is around light quality. And what we're seeing from this graph is that in every sector, except for residential, light quality is the number one aspect to consider, the most important consideration in a purchase decision.

In the residential sector it's basically neck and neck with price. So, that's -- we'd expect price to play an important role. I think everybody has always known that. We've been trying to get prices down.

But this shows that light quality is right there with it. Price is definitely not the only consideration.

The next slide; another study was done just a

couple of years ago by Southern California Edison that dug into this price issue. And they actually did a trial at a bunch of retail locations and played with rebate amounts to impact end-user prices. And they would raise them and lower them for different lamps, at different times, in different places to see what would happen.

And I think no surprise they found the LED market was very price sensitive. They definitely saw a response to lowering prices.

But beyond that they found some additional -- they came to additional conclusions, which are very interesting.

One, high sales volumes in early months after the introduction of a -- or after a price reduction didn't -- was not indicative of higher sales in later months. Sales often would slow after an initial surge.

Another thing they found is that if you follow those customers home and find out whether they liked the light bulbs it's a different story.

Some people might be dissatisfied. So, just because you've increased sales initially doesn't mean that these people are going to be repeat customers or going to buy -- you know, fill more sockets with these lamps.

And a couple more tidbits came out of this study. An interesting quote there, “The goal of influencing consumers to purchase existing LED products can dominate the vision of the industry. Perhaps an equally desirable goal would be to prevent consumer dissatisfaction with the LED products once installed.”

So, it’s not just trying to get people to buy them, it’s trying to get people to keep them and buy more of them.

It could do harm to the reputation of LED technology to compromise the drive toward higher quality.

So, that’s what has brought us all into this effort, trying to maintain consumer confidence in high-efficacy lighting, in a new high-efficacy lighting, namely LEDs.

The next slide; so we’ve focused on a number of different aspects of LED lighting or of lighting in general. And I’m going to -- I have two slides that focus on two of those aspects. Color quality and flicker we’ll get to in a moment.

But there’s been a lot of attention paid to color quality and color rendering, and that’s the ability of a light source to accurately render the colors of the objects that a light source illuminates.

So, color rendering index is the most common metric used to define a source's ability to render colors. And there's been a lot of studies into it over the years.

The most recent one that I just highlight here is from Kevin Houser at Penn State University, just this spring did a test and compared high CRI LED sources to lower CRI LED sources and found what I think are pretty compelling results.

If you look at the graph on the right, you can see consumers' ratings of the products, four different colors.

So, do you prefer the way this light renders red or the way this light renders red is essentially the question, and you run through all the color samples.

And the dots that appear off to the right side of the graph show a clear preference for the higher quality, the higher CRI sources.

So, we see that for cosmetic colors, for reds and for whites there was a clear preference for the high CRI.

And then in the overall category which light do you prefer? And there was a clear preference for the high CRI product.

And then there were a number of products where

there was really no preference, they were right down the middle in that neutral zone.

So, just one example, but this is sort of supporting the direction that California has been moving around trying to improve color quality.

The next slide; so flicker and flicker is really just light modulation and it exists in essentially all electric light sources to some degree.

But if flicker is too great, if the frequency is too small or the amount of modulation is too high it can be really noticeable and really annoying to people. It can also have adverse health impacts.

So, this is a study that LRC did a few years back, where they exposed people to different levels of flicker at different frequencies.

And you can see the top left, or the top graph is whether people could detect the flicker and the bottom graph shows whether it was acceptable or not.

And in both the upper left corner is sort of the danger zone. That's where you have either high flicker or low frequency, or both.

So, that's the zone that we've been targeting in on and trying to make sure that if we're going to roll, if we expect LEDs to catch on, we have to make sure that they're not up in that left-hand corner.

So, next, if you click forward I think we'll see that's the zone that we are working against right now, trying to avoid flicker below 200 Hz. And that's represented by those two rectangles there.

So, that's already a requirement for controls, but we're now rolling it out for light sources.

The next slide. Okay, so now I'm just going to -- this is the meat of the proposal for JA8 here and the changes that have been proposed.

JA8, Joint Appendix 8 already exists and it's currently specific to LEDs, LEDs that are being used to comply as high-efficacy lighting.

But we're changing it around so that it will be technology neutral and it will also include replacement lamps regardless of base type. It currently only applies to non-screw-based LEDs.

So, now this is going to be the home for screw-based high-efficacy, high-quality sources.

So, in that proposal right now it already has a requirement for 90 CRI. We're proposing to maintain that.

For indoor sources, the requirement for color temperature is that it fall between 2700 and 4000 kelvin.

What we're providing is that the source be

capable of providing warm light at 3000 kelvin or less.

So, that's something to point out. There's been a lot of discussion about that point, in particular. And we're not -- we don't want to do anything that would ban 5000 kelvin or higher color temperature lamps.

But what we're saying is if you're using JA8 to comply as a high-efficacy screw-based source, you'd have to be a color changing lamp if you wanted 5000 kelvin. As long as you can meet the requirements at 2700 or 3000 kelvin that's fine, if you can also provide light at 5000 kelvin.

We're proposing to remove the outdoor designation entirely from JA8.

And then efficacy we're not proposing to change. It would still be the same as the table that's in there right now.

So, it is based on wattage, you know, sources in the 5 to 15 ranges would be 45 lumens per watt.

The next slide; so continuing to run through some of the other revisions that have been proposed for JA8, most of this is based on work that's been done already, namely, the CEC's voluntary quality spec that was passed a year ago, or approved a year ago.

There's a current Title 20 proposal specific to LED lamps that is under development.

And Energy Star has plowed the way for a lot of these quality requirements for light bulbs in their latest light bulb spec, or lamp spec.

So, as I mentioned, color temperature capable of 3000 kelvin or less.

We're also proposing a DUV requirement, which is the distance from the black body locus. So, rather than trying to put light sources into specific quadrangles we're, instead, defining a distance from the black body of .002 in the 1976 CIE color space.

We're proposing to add a color rendering R9 value of 50, which is the ability of a light source to render deep reds.

We're proposing to require JA8 sources to be dimmable down to 10 percent, to provide reduced flicker operation in the full output and in the dim state of 30 percent flicker at frequencies less than 200 Hz.

Noise requirement which is the same as Energy Star, but tested at 100 percent and 20 percent of full light output.

Power factor of .9, start time of .3 seconds, and elevated temperature requirement also the same as Energy Star's requirement, except we're proposing it for all lamps.

And that requirement is that if you test your

lamp or your source at 45 degree Celsius, it has to maintain 90 percent of the light that it provided when you tested it at 25 Celsius.

The next slide; the last few requirements or proposed revisions to JA8, first there are a handful of life-related requirements.

We saw before the early failure was a big problem with CFL, so these are all designed to get at that.

The first is a requirement that nine out of ten lamps tested must still be operational at 3,000 hours.

They must have a minimum rated lifetime of 15,000 hours.

Lumen maintenance must be 86.7 percent at 6,000 hours. Again, that came -- this is consistent with Energy Star.

And we're proposing a five-year manufacturer warranty.

The next major category there is something that will apply only for LEDs. And that is LED sources complying with JA8 must meet NEMA SSL7A, as either a Type 1 or Type 2 product.

NEMA SSL7A is a spec passed last year that is working on compatibility between LED sources and dimmers.

And the industry reaction that I've heard so far is very positive. Testing has been going on of that spec all year, so we think it's in good shape to put forward in code here. We're interested in hearing comments on all of this, of course.

And then, lastly, is certification and labeling requirements. Products must be labeled as meeting JA8 and then there are a few other lamp markings that we would like to propose, as well, or source markings I should say for wattage, for lumens, color temperature and CRI.

The source must be certified to the Commission in the Appliance Efficiency Database, as we've designed the proposal so far, and it must be labeled with the manufacture date.

And that last one is actually already a requirement in Warren-Alquist that products complying with Title 20 need to post the date of manufacture on them. But we are reinforcing it here and making it a little bit more specific as to how the format of that date has to be so that it can be read by your average consumer.

And so that really covers it. The last three slides were the meat of what we're proposing for screw-based or any high-quality high-efficacy source that is

using JA8 to comply.

There's a couple more slides that just get into some of how the market performs and whether these requirements are being met, and at what rate, so we'll go through those real quick.

PG&E funded a large amount of -- a large testing program at the California Lighting Technology Center, over the last couple years now, looking at a lot of these metrics.

Some of these metrics are not commonly reported on packaging, so it's hard to tell how the market performs.

But in terms of the color consistency, almost half of products seem to be able to -- if you test ten samples, have nine of ten fall within a four-step quadrangle, which is essentially what we're proposing now with the .002 DUV requirement.

Most products pass the flicker proposal. I think that says about 60 or 70 percent.

Again, most products are providing power factor greater than .9, again about 60 percent.

Efficacy is the easy one for LEDs. Just about every product meets that.

Most products are dimmable down to 10 percent. And most meet the early failure requirements.

And this is an important thing to note here. This is from a collection of lamps that were gathered in 2012. So, we've seen performance improve since then.

So, somebody asked a very good question at the May 15th meeting. How many products met all of these requirements?

And the answer is in that -- in the group of products that we collected in 2012, none. There have been products since then. So, we've been testing products as they come out and there are now a handful of products that can meet all of these requirements.

And we expect to see the market continue to go in that direction.

The next slide; CRI is the big one where there aren't a lot of products. It's definitely the minority of products that meet the CRI proposal.

But this shows a snapshot of the trends over time since 2010. We've been monitoring the Lighting Facts Database every few months for the last four years.

And you can see the trends among LED replacement lamps are going up. So, you know, the highest CRI lamps have been above 90 and increasing. And average CRI is increasing as well from 80 up to 85.

The next slide; this is a different way to look at the Lighting Facts Database. If you look at color

temperature, the vast majority in that top graph, the vast majority of lamps are already in the 2700 to 3000 kelvin range.

If you look at CRI in the bottom left, you can see that -- and why don't we -- I think there's an animation here, so go to the next slide.

In the bottom left graph you can see that it's less than five percent that has 90 plus CRI. And an R9 of 50 is also about five percent, five to ten percent that has a value of 50.

So there are -- that's the small, the metric where a small portion of the market is meeting it, but the trends are moving in the right direction.

So, I believe that covers it for my section. Can you try the next slide and -- yeah, so I'm going to pass it back to David for the last remaining slides of the presentation.

MR. DOUGLASS-JAIMES: Great.

MR. MC GARAGHAN: Did it pop up, David?

MR. DOUGLASS-JAIMES: Yeah, hang on one second here.

All right, so we have a few more slides. I'll try to go through them quickly so that we can leave plenty of time for comments and discussion.

In terms of enforcement, we think this is, you

know, pretty consistent with what is already required. It's, in fact, maybe a little bit easier. Just confirming hard-wired luminaires meet the high-efficacy requirement.

And then any luminaires with other traditional incandescent bases will have JA8 compliant sources. Which as Mike mentioned will be labeled as such.

And in addition, we are proposing that lighting schedules be given to the new homeowners so that they are aware of what the lighting is that they -- that's been installed and that they're entitled to these high-efficacy, high-quality sources, and prevents the removal of those lamps from the house prior to occupancy.

Quickly, just going over the methodology for the savings, we looked at some analysis building on previous case efforts, with updated data.

A note on the prototype buildings, because the residential standards are based on room types and the prototypes don't specify room types, we've used some average unit information that we obtained from the lighting inventory data of the sources that we used.

Which I've sort of outlined here, the main source of lighting inventory data comes from the Efficiency Characteristics and Opportunities for New California Homes from 2011. And we've done some

modifications to that to reflect the 2013 standards, as I mentioned previously.

We also looked to a few of these other resources, the DOE study, as well as some utility data, and non-California data to sort of do a sanity check on the data that we were seeing from the first study.

And we looked to the final evaluation reports for the Upstream Lighting Program for hours of use data.

And so to just sort of recap what we discussed previously, the total energy savings for the proposed measure is about 625 kWh per year, which translates to about 13,000 kBtu for the TDV electricity savings.

And for the cost savings, again, about 16 recessed luminaires and 21 screw-based sockets, using these projected costs for 2017, as compared to the base case scenario, the incremental construction cost is about $365.

And the maintenance cost is reduced. Again, providing a benefits cost ratio of about 6.56.

We also did a quick consumer cash flow analysis, assuming that those initial costs are spread out over the cost of a mortgage, and you can see that the key here is that the break-even point based on the energy savings versus the first-year costs of the measure is just -- is after just one year of occupancy and

installation of these sources.

Obviously, in the 24th year the cost of replacement is relatively high. But overall, the net savings is pretty significant compared to the costs.

And again, we expect the LED costs to continue to decrease into the future.

And LED lamp costs are projected to be on par with CFLs pretty shortly and definitely before these standards go into effect.

So, just to summarize again the proposed code changes, the all high-efficacy requirement will replace all of the room type requirement sections.

And again, maintaining consistency with the existing controls requirements, at least one luminaire controlled by vacancy sensors in bathrooms, garages, laundry rooms and utility rooms.

And then dimmers or vacancy sensors required for any screw-based fixtures using JA8 sources to comply with the high-efficacy requirement in all room types other than kitchens, bathrooms, garages, laundry rooms and utility rooms.

And this will actually pretty significantly collapse and simplify the code language in the residential section.

So, the tables; Table 150.0A is revised to

reflect the changes in high-efficacy definition, the addition of the screw-based sources.

Table 150B will be deleted. That's actually sort of taken into the JA8 appendix. And then changes to JA8 as Mike described.

And then we have the details about the changes to the proposed code language, which I know it's a lot but I'm going to go through pretty quickly in the interest of time here.

Some changes to definitions, including CRI and color temperature, just adding those in.

And then in the actual Section 150K, residential lighting, here you'll see -- it's a little hard to see with all the strikethroughs, but all installed luminaires shall be high-efficacy in accordance with Table 150.0A.

And then we're able to remove a lot of other sections.

Going forward here is the piece that specifically reflects the recessed luminaire requirements.

Let's see, noting that they will be required to not use screw-based lamps and have JA8-compliant light sources.

And again, just noting that any screw-based

luminaires shall be required to have JA8-compliant lamps.

And a note here requiring the fixture schedule for homeowners.

And then controls, most of this is consistent with what's already required. An addition here that all dimmers installed need to comply with NEMA standard SSL7A, as Mike mentioned, for compliance with the LED lamps.

And then bathrooms, garages, laundry rooms, utility rooms shall have at least one vacancy sensor, and then any screw-based fixtures controlled by dimmer or vacancy sensor.

And then as you'll see, all of the existing room-based requirements can be removed. Pretty consistent with the outdoor, some minor edits here.

And then Table 150.0A, which defines all of the high-efficacy light sources, with the addition of any luminaire containing a lamp or light source that complies with JA8 and labeled as such, other than recessed light sources.

But otherwise, again, just to reiterate, all the existing -- all the existing fixture types that currently comply as high-efficacy sources are still considered high-efficacy sources.

And again, Table 150B is deleted.

Just adding some references here in terms of the sources for some of the standards.

And then, Mike, was there anything that you wanted to touch on that hasn't already been covered for the JA8 revisions?

MR. MC GARAGHAN: I don't think, so, but we can all -- I'll go through the next few slides here.

MR. DOUGLASS-JAIMES: All right.

MR. MC GARAGHAN: So, these are the actual revisions to JA8 and the primary thing going on here is making them technology agnostic, removing LED and really focusing on light sources.

The next slide; this section edits the existing language around color temperature, specifying that the light has to be capable of providing the warm color, but that color-changing lights are okay.

It also removes several of the requirements that were specific to LED or LED lamps.

And I think we can go to the next slide. And these are all additions. These are the ones discussed before. This is how they're actually mapped out in the code language.

One thing I didn't point out before is that some of these requirements or proposed requirements need test

procedure revisions. There aren't established test procedures for all of these.

Some of them we're planning to utilize, the Energy Start test procedure, and in some cases we have a proposed test procedure being developed specifically for this requirement.

Most notably flicker. There is no industry standard flicker test procedure at this point. We've been working on one and we definitely look forward to getting feedback on that procedure. But all of those things will be included in Appendix JA8 eventually.

The next slide, yeah. Again, that was, yeah, very focused on LEDs.

This is some of the labeling and marketing requirements around California JA8 compliant and data manufacture, and the requirement for LED-based sources to meet SSL7A.

The next slide; and beginning to identify test procedures, as mentioned. Many of these are just industry standard test procedures.

The next slide; and lastly, the efficacy table that we mentioned before. I believe that is the last JA8.

MR. DOUGLASS-JAIMES: Yes.

MR. MC GARAGHAN: So, here's a slide on low

flicker operation test method. This is -- there have been a number of different stakeholders contributing to this, the development of this test procedure.

And as I'd mentioned, we'd open additional input.

But the CASE team and with a lot of support from Jon McHugh, and California Lighting Technology Center, as well as other stakeholders, like Michael Poplawski at Pacific Northwest National Labs, have been developing what we'd like to roll out as a flicker test method in California.

Jon, is there anything you want to speak to regarding this slide right now?

MR. MC HUGH: I think I'll respond to questions, if any arise.

MR. MC GARAGHAN: Okay. Okay, and back to you, David.

MR. DOUGLASS-JAIMES: So I think that's just a -- yeah, so I think this slide is just a little bit more detailed on proposed test methods.

So, again, just a quick summary of the primary impacts; down lights will be required to be JA8 compliant and not use screw-based lamps.

Any other luminaire can be classified as a high-efficacy luminaire, provided that it has a high-

efficacy, high-quality light source that complies with JA8.

And any type of lamp or light source can be eligible to meet JA8. So it's, again, making it technology neutral, not just LEDs as it currently is.

And then GU-24, linear fluorescent HID, all of the things that currently comply as being high-efficacy still comply as high-efficacy without needing to comply with JA8.

A quick summary of some of the feedback from the stakeholder meeting from May 15th, the stakeholders noted that -- so, this has been integrated. The stakeholders preferred a requirement for dedicated down lights, rather than allowing JA8-compliant reflector lamps.

And they expressed support for emphasis on product quality. Although, again, and I think some of this has been addressed in this presentation, there were concerns about allowing cooler color temperatures.

And things like lamps that shift red when dimming that may make -- incandescent products should be allowed.

And again, I mentioned that NEMA SSL7 is not technology neutral and so that's been reflect to only apply when -- in relation to LEDs.

And notes are available. The notes from the full presentation are available.

So in general just some, you know, requests for feedback and comments, and any additional data that might be helpful.

And I think that's the end of our presentation and we can open it up to questions and comments.

MR. SHIRAKH: Thank you, Mike and David. I should point out that one of the advantages of this proposal is that it will greatly simplify the compliance with the code.

You know, right now, for instance for kitchen lighting we have all these rules about 50 percent of the watts should come from high-efficacy sources, and then we have additional allowances based on the square footage of the house, and some of the other things that can take place relative to laundry room and exterior lighting. And all of that will go away. Basically we can condense the language greatly and eliminate a bunch of forms and worksheets. So, that is one advantage.

So with that, I'd like to open up to public questions and comments. First, we're going to start with in the room and then we're going to move to the web.

So, is there anybody in the room who would like

to comment on this?

Please, come up to the podium. As I mentioned, you need to introduce yourself and your affiliation, and preferably give the court reporter a business card.

MR. COOK: Keith Cook from Philips. Yeah, I have quite a few comments. I was a little bit disappointed we didn't have this presentation ahead of time so we could have been maybe a little bit better prepared. This is quite a change.

A couple of comments, though, I think that first off I'm a little concerned that California may be overreacting to CFLs.

Granted, CFLs have not been the best product we've ever brought to market. But if you look at the data, unfortunately, which was not included in this presentation on how LEDs are doing, across the country the adoption rate is far outstripping CFLs by a long shot.

So, the emphasis on trying to improve that adoption rate through better CRI is not necessarily needed or, in fact, may be in the wrong direction.

Because if you actually look at retailer sales data across the country, the adoption rate in California for LED products is lower than other states in this country.

And we feel a large part of that is because of the rebate situation due to the LED quality specifications.

I also think that we're being misled when we equate CRI to lighting quality, as was done in this presentation.

Because lighting quality is a whole lot more than just color rendering index. It gets into having the right amount of light at the right location, with the right color. And those are metrics far beyond just CRI.

The other thing which kind of surprised me was the emphasis on power factor. Maintaining the .9 power factor also may be in the wrong direction.

And the reason I'm saying that is as it turns out the power factor in most of our drivers is due to the capacitors that we use for, oh, smoothing.

And as it turns out, the imaginary power that's generated from that capacitor offsets the inductive loads that you have in the house, such as the starters in your refrigerators, the motors, the compressors, the washers, the dryers, et cetera. It's unbelievable the number of motors that you've got.

And they're actually being compensated for by the drivers and the ballasts that are in the house.

So, it actually is a mistake to reduce that offsetting factor.

So, I think that you may need to look at what data is driving the need for this .9 power factor.

So, I'm a little concerned that we're actually driving the cost up with this proposal and reducing the efficacy.

When California first came out with the LED quality specification, one of the lamp manufacturers came to market with a bulb that was identical to one that they already had, that met the California requirements.

The interesting thing was it was 40 percent more expensive and 40 percent less efficacious.

So, if California is interested in saving energy, this is not necessarily the right way of going. Thank you.

MR. SHIRAKH: Thank you.

Mike Hodgson.

MR. HODGSON: Mike Hodgson from Con-Sol, representing CBIA.

I have kind of a series of questions. It appeals, the proposal appeals to us because it's so -- it's simplification of the standards.

But if we could go to slide four, I kind of want

to get my bearings here on what the market is. I believe this was a description of what was low-efficacy in existing housing.

And I believe there was a statement by David that 80 percent of the lights in the home are low-efficacy and I would like a little definition on that, if we could. Because you broke it down and I just don't remember exactly.

Yeah, so in this slide I believe you're talking about, and I also -- I think it's 79 percent of the wattage in a home is incandescent. Is that correct?

MR. DOUGLASS-JAIMES: Yes.

MR. HODGSON: Okay great. And of that, how much of that wattage is regulated wattage and how much is unregulated?

MR. DOUGLASS-JAIMES: So, this is all permanently installed fixtures. Any sort of portable fixtures are not included in this figure.

MR. HODGSON: Okay, and so what code were these homes? You said you surveyed the homes in 2011. Were they built to the 2010 Code or 2008 Code?

MR. DOUGLASS-JAIMES: So, these were built to 2005 or 2008 code. This makes -- these numbers, I believe, make a small modification based on the changes to the code for the 2013 standards, which it resulted in

a slight reduction because of the new requirement for at least one high-efficacy source in bathrooms; but based on the inventory data that we had from this report that didn't result in much of a change in terms of the source watts that we saw.

I mean based on -- based on the inventory, itself, I believe and I'm not entirely sure, this is my memory here, but I think it was something like 81 percent incandescent and 2 percent halogen. And then when we made the modification to reflect the proposed -- the 2013 standards, the assumption that we made shifted that to 79 percent and 2 percent.

And again, this is source watts. This isn't fixtures. So, if we got to the next slide, it breaks it down a little bit different.

MR. HODGSON: Okay, can we go to the next slide, then?

MR. DOUGLASS-JAIMES: So you'll see the wattage, the low-efficacy wattage is 81 percent, but if you look at just installed lamps it's 62 percent of the lamps are low-efficacy lamps and 38 are high-efficacy, which would include CFLs that are installed in screw-based sockets.

Which is sort of why we included the next slide on that table there, which shows that 70 percent of sockets are low-efficacy, so typically screw-based

sockets; although, at least 8 percent of those sockets had high-efficacy screw-in lamps according to the data that we used.

MR. HODGSON: Okay, so 70 percent of the sockets were screw-in, and these are basically down lights, I would presume, and did they meet --

MR. DOUGLASS-JAIMES: Any source. This is all sources, all fixtures.

MR. HODGSON: Right, but these are permanently installed; correct?

MR. DOUGLASS-JAIMES: Correct.

MR. HODGSON: Right, so that --

MR. DOUGLASS-JAIMES: But also, you know, so ceiling mounted, wall sconces. This includes things like bath bars which make up a large portion of the low-efficacy watts in a lot of the homes.

MR. HODGSON: Okay, but these homes met code, then?

MR. DOUGLASS-JAIMES: Yes.

MR. HODGSON: Okay, and that’s what’s confusing to me is I don’t know how you can have that many sockets that are screw-in, not controlled by some type of sensor that would then be low-efficacy.

MR. DOUGLASS-JAIMES: Well, assuming -- I mean these are all assuming all of the low-efficacy or the

screw-based sockets are controlled by either vacancy sensors or dimmers as required.

MR. HODGSON: Okay, so they met code, all right. So, all right, so let me just go to I think Slide 10, then, where you have low-efficacy down lights. And the amount of dollars, I just wanted to make sure that the dollars you're counting are strictly from regulated loads; is that correct?

So, the savings that you're projecting by switching to this assumes that your low-efficacy lights are already controlled by vacancy sensors, right?

And then, in addition, there's no other energy savings being gleaned here from non-regulated loads?

MR. DOUGLASS-JAIMES: So, the question for down lights is a little bit more problematic because it's not just the low-efficacy down lights that are being replaced here. It would be any other -- basically, any non-dedicated JA8-compliant source down light, or Zhaga or quick connect.

So, that's maybe something to clarify that for down lights it has to be a dedicated LED source or similar, complying with JA8.

Whereas for everything else it just requires a JA8-compliant lamp.

So, the costs assume replacing every down light,

even it was previously -- even if it previously qualified as high-efficacy, if that sort of clarifies that.

And then I may have lost the question.

MR. HODGSON: The second part of that was you were assuming some savings here, correct? You're estimating energy savings in dollars --

MR. DOUGLASS-JAIMES: Correct.

MR. HODGSON: -- and energy saving.

MR. DOUGLASS-JAIMES: Yes.

MR. HODGSON: And those are only coming from the fixtures, basically incrementally changing to this new requirement.

MR. DOUGLASS-JAIMES: Well, yeah, so the down light's changing to JA8-compliant dedicated sources and any screw-based or low-efficacy socket changing to a JA8-compliant high-efficacy source.

MR. HODGSON: Okay. It would be great to get some of your math, then. We'd like to try to follow it because we're not quite following it.

MR. DOUGLASS-JAIMES: Right.

MR. HODGSON: So, appreciate it. And also, I'd reflect the comment it would be great to get the presentation ahead of time so that we could take a look at it. And I understand timelines are difficult.

But a couple of other quick questions, Mike, you mentioned that some of the test procedures do not exist, yet, that you're trying to develop, that you would like to put into, I presume, JA8; is that correct?

MR. MC GARAGHAN: That's correct.

MR. HODGSON: Okay, so code's going to be attempted to be presented, according to Mazi, by the end of this year. Are those test procedures going to be finalized by the end of this year?

MR. MC GARAGHAN: Yes.

MR. HODGSON: Okay, so they will be adopted as ANSI standards or some type of standard?

MR. MC GARAGHAN: They'll be adopted in Title 20.

MR. HODGSON: The test procedures will be adopted in Title 20?

MR. MC GARAGHAN: That's the plan.

MR. HODGSON: Right, but they're going to reference a standard; correct?

No, you're going to actually explain the test procedures in the Administrative Code?

MR. MC GARAGHAN: Or specifically for flicker there is no existing ANSI test procedure.

MR. HODGSON: Okay, so you're going to write that into code?

MR. MC GARAGHAN: Yes.

MR. HODGSON: Okay.

MR. MC GARAGHAN: I mean we would love to work with the ANSI Standard community to adopt it in ANSI, as well, but at the current pace we're moving that was how I envisioned it.

MR. MC HUGH: Okay, so why don't I answer the question that you've just asked Mike. This is Jon McHugh, McHugh Energy.

And currently there is a test method for testing flicker in Energy Star. However, that test method in Energy Star is actually more stringent than the requirement that we have here.

And the issue is that the flicker measurements that are required by Energy Star, now it's required as they test and list in Energy Star.

For Title 20, we're using the existing definition that's been in place since 2008 and the definition allows products to have higher levels of amplitude modulation or percent flicker at higher frequencies.

So, what we're doing is we're taking the same Energy Star standard and we're allowing the date to be filtered, basically a low-pass filter to look at those frequencies less than 200 Hz.

Does that answer your question?

MR. HODGSON: No. I really don't care.

MR. MC HUGH: Okay.

MR. HODGSON: The issue is we don't want to adopt something that doesn't have a standard and reference in a building code.

And so, you know, I think it's probably a great idea to do it. I'm not objecting to it. I'm just saying let's not adopt something in Title 24 that doesn't have a reference that we can go back to because that's how we get our code disputed, and we'd rather go forward cleanly.

So, if there's a standard in the marketplace, please adopt it.

If there's not, you know your deadline. You need to get it done by the time 45-day language comes out. That's my point.

I'm not the technical person on lighting. I'm just trying to say let's do this cleanly.

The last question I have for Mike is one of the things you mentioned are these six different new requirements that you would like products to meet and you had, you know, charts on each one of them.

But you made a statement which kind of alarmed me and you said that not all of them meet, or very few

of them meet all of these requirements.

So, what's the anticipation, and maybe we should hear from the manufacturers, that they can meet these requirements in the -- again, I'm looking at the time frame. We're going to code, we're going to adopt sometime at the end of this year. Actually, formally, early next year, but it's got to be in language.

So, we have to have a product that's realistic at that time.

So, is it your estimation that that product will exist at the end of the year?

MR. MC GARAGHAN: Yeah, the product does exist from -- in at least a couple of different form factors from a couple of manufacturers.

But what I was saying is that when we started our testing program in 2012 there were very few products.

MR. HODGSON: So, what's your estimate of the market today that would meet those characteristics, what percentage?

MR. MC GARAGHAN: I don't have a percentage estimate, but I have a -- there are somewhere -- and this question came up on the May 15th meeting. And the IOU program managers are the people who are currently running rebate programs around a very similar spec.

MR. HODGSON: Okay.

MR. MC GARAGHAN: And they are collecting input from manufacturers.

And Richard Greenberg, from SCE, said he had over 25, I want to say 20 to 30 submittals to him that he believed met this spec.

In terms of products that I've personally seen on the shelves, it's -- at this point, probably ten. But that number -- a lot of this is responding to the momentum in the California Quality Spec, which has just come into play in the last six months.

MR. HODGSON: Okay. Well, that's just a concern that we want to make sure there's product available. Thank you.

MR. SHIRAKH: Bob Raymer.

MR. RAYMER: Thank you, Mazi, Bob Raymer with California Building Industry Association.

It was mentioned earlier on in the presentation that there are some new Federal requirements for high-efficacy coming online in 2018. Do we know what month in 2018?

MR. MC GARAGHAN: January 1.

MR. RAYMER: Oh, great.

MR. DOUGLASS-JAIMES: I believe it's January 1.

MR. RAYMER: Oh, good. And we don't need to

discuss it now, but if you could perhaps provide me with sort of a listing of the features in the Federal standard and how they relate to what's being proposed here?

From a marketing tool, it really helps me to sell to the membership. Yeah, we're doing it early but, you know, it's coming anyway. That was a big help with the last air conditioning upgrade, so that could be very helpful.

This is going to be repetitive, but I've got -- two of the things Mike brought up I've got some issues with.

Regarding the test procedures and their completion, you're going to be doing one or more test procedures in Title 20, as I understanding it. And if everything stays on track the test procedure that you're talking about, that the manufacturers have to meet, would be approved and published in Title 20 sometime in December of this year?

MR. MC GARAGHAN: The Title 20 schedule is -- I don't think is finalized, but it is moving forward in the next year, yes.

MR. RAYMER: Okay. Just looking ahead, I realize that you're trying to get a lot done simultaneously in sort of different venues. Do you

anticipate any problem whatsoever with the manufacturers on the Title 20 aspect of this? I mean is it something that they're going to be -- I know I'm asking you to look into a crystal ball, but is it possible that they're not going to like what goes into Title 20?

Unlike Mike I have no clue as to how this is going to play out with the manufacturers or whatever. What I'm worried about is the administrative log jam where we get into 2015, you're getting ready for an adoption and, particularly, if it's not settled out by the time it goes to Building Standards Commission that would be a violation of one of their criteria.

And so, you're doing parallel tracks. What's the potential of it not working out well, I guess?

MR. MC GARAGHAN: Yeah, it's a great question and I'd love to hear from the manufacturers in the room on that.

I think what Jon mentioned is that the test procedure is sort of leveraging the Energy Star test procedure, which has been in place and had a public proceeding for over year. So, it's not like it's a brand-new concept.

MR. RAYMER: Sure.

MR. MC GARAGHAN: So, hopefully, it's something that is, you know, the manufacturers are familiar with

and working on already.

MR. RAYMER: Okay, if you look at slide 19, this has got the listing of the various features, it's my understanding that compliance is actually going to be simplified somewhat.

But am I to understand that the builders' subcontractor would provide to the builder, who would then provide to the building official a schedule of the lighting that has all of this addressed on it?

I guess my question here is the building official and the subcontractor going to clearly understand all of this?

MR. MC HUGH: Yeah, I think that, yeah, so that's a really good question, Bob.

The issue -- by the way, this is Jon McHugh. The issue is that how this is enforced is through the label on the light source. So, light source says JA8, so the inspector doesn't need to know about McAdams steps, or any of that other kind of folderol. It's all the label on the lamp, yeah, that's what they're looking for.

MR. RAYMER: Perfect, perfect.

Okay, moving on to slide 21, the same question Mike had, a little bit differently here. The one product that currently meets all of this, when we were

back in May there wasn't the product, but now there is, is it typical in terms of the cost range? Is it a high cost item? Do you anticipate the other manufacturers very quickly kind of -- we've had some bad experience with lighting over the last 15 years, kind of off and on, and it's all very public.

We're going to be trusting the Energy Commission as they go forward on this. I'm sure the manufacturers have issues and they're going to raise that.

We're assuming that there's going to be a wide array of available product throughout the State that we can have access to that meets this. And that a builder or a subcontractor who doesn't quite understand all this, you know, if they go for a lower-cost product are they -- is that going to be a bad idea? I mean do they need to go Mercedes as opposed to HUGO? You know, where are we?

MR. SHIRAKH: Jon.

MR. MC HUGH: So, you know, these are great questions, Bob, and I almost feel like you're -- we've almost planted you in the audience.

MR. RAYMER: No, Mike did.

MR. MC HUGH: Oh, okay.

(Laughter)

MR. MC HUGH: The issue is that for the first

time we're going to be looking at a set of luminaires that can comply with the base type that's been around for over a hundred years, which is a screw-based lamp.

So, the issue that you bring up is the issue of how many lamps are available.

But think about the amount of product that has a screw base as compared to the amount of products that are JA8 or the other sort of high-efficacy bases that were required in the last round of standards.

MR. RAYMER: It's a lot.

MR. MC HUGH: So, this is going to immensely increase the amount of products, of all types, that will be able to comply just as long as they have the JA8-labled lamp.

MR. RAYMER: Thank you.

Okay, and in conclusion, and this gets a little bit off point for this morning's discussion, but it will be sort of the mantra as we go through the workshops into July and August.

And that is this set of proposed regs, you know, in the -- taken separately, the individual items make a great deal of sense. We're going to be very interested in the combination. Just like always, we're going to be very interested in the end-of-the-road compliance when you put all of these individual measures together.

Not just lighting, but advanced wall systems and high-performance attics. Two huge changes in common construction design practice. Yes, they can be done. But can they be done quickly and can they be done quickly and very well?

And so, as we go forward with this we're going to be very interested not only in total compliance costs, but is it reasonable to be able to expect industry to be able to handle this magnitude of change in a short period of time.

So, it's not just a cost issue. It's can high volume production housing, you know, overnight kind of get this into it. So, thank you very much.

MR. SHIRAKH: Thank you, Bob.

Before I go to the next presenter, I want to go back to the comments that were made by the representative from Philips. I mean he raised some issues that related to CRI, the power factor, the source efficacy.

I was wondering if our team has any response to any of those questions. I know it's going to come up time and time again, and it's been something we've been discussing.

So, are there any responses from our team or people in the audience?

The gentleman?

MR. WHITEHEAD: I'd be happy to respond to the color rendering in that question.

MR. SHIRAKH: Okay, please identify yourself.

MR. WHITEHEAD: Thank you. Good morning, I'm Lorne Whitehead, a professor of physics and a professional engineer at the University of British Columbia.

But probably more relevant to today, I serve on the International Lighting Commission and I'm a member of the Technical Committee 190 that's working on improvements of the color rendering index over time.

And maybe I'll just start out by saying those improvements, while they're coming, aren't in any way related to the conversation today. The color rendering index itself works fine, and it will continue to work fine with a few tweaks in the future.

But the key thing about it is that a number of people are actually unaware of what it does. To put it very simply, the color rendering index assesses the degree to which colors look weird under lights that have the low rating, in layman's terms.

And that's a very important part of color -- of lighting quality. It's extremely important.

But it's not the only part. So, it's a false

criticism to say that the changes that are proposed today are equating Color Rendering Index to quality. It's just one component.

But the way quality works is through a number of key components. And if anyone of them is missing, you don't have quality. So, it's an essential component to quality.

And so the only question, really, is what's an appropriate amount?

And in the construction industry the default approach to quality is the quality should be high enough that it doesn't look weird.

So, if you ask what's the required quality metric for a vertical wall, or a horizontal table surface? It shouldn't look crooked.

And in the case of lighting, unfortunately, until about five years ago, it really wasn't practical to have light sources that didn't make things look crooked.

Today it's extremely practical. And so, there's a need to make it happen.

The unfortunate fact is ordinary consumers know nothing about this. So, they go into the store, they buy a product, they bring it home, or they buy a house with a product in it and things just don't look right,

but they don't know why.

We know that we can measure that they don't look right, but people don't know why.

And so, that's why it's the responsibility of regulators to make sure that products are the optimum solution.

And that brings up an interesting question; what is the most efficient light?

It's absolutely not the most efficacious light. If it were, we'd have yellow sodium lighting everyone. No, it's just not.

So, the most efficient light is the light that best meets human need.

And, in fact, Color Rendering Index helps dramatically in that regard.

So, there's no need to use more energy to have high color rendering index. People are happier with less light. I should say people are happier with fewer lumens, if they are high color rendering lumens.

There's often a lot of confusion between lumens and light. Light is radiation really throughout the visible band. Lumens puts a heavy emphasis on the central portion of the spectrum which matters to some engineers, maybe some old-fashioned engineers. It doesn't provide what people need.

So, the emphasis is on need. And I'm just very, very in support of everything we've heard today from that perspective.

MR. SHIRAKH: Thank you, appreciate it.

Now, I must say in my own home I'm blessed with both 80 and 90 CRI LEDs and I can certainly tell the difference. It's very striking.

And there's a question about the efficacy of different light sources that, you know, we've heard the terms like 40 percent less efficacious for lower CRI sources.

Is there any response to the source efficacy and also, you know, is there a trend between now and the next two and half years, before the code goes into effect, that they might narrow that gap?

Could you, please?

MR. WHITEHEAD: On the topic of efficacy, again not that that represents efficiency for lighting, but on that topic it's true that if you spread light evenly, as people prefer, throughout the spectrum some of that light is in the far red end of the spectrum that produces fewer lumens.

And so if you ask the question fundamentally, going from 80 CRI to, say, 90 what is the required change in efficacy to make that possible?

Estimates are about 10 percent.

I'm sorry, sir?

MR. SHIRAKH: So, the commenter mentioned that the difference -- the difference is 17 percent, not 10 percent.

MR. WHITEHEAD: I think it's possible that the apparent disagreement is a matter of terminology.

So, the fundamental issue with light is related to an idea called the luminous efficacy of radiation. And this is -- it's hard physics.

So, in the hard physics when you do the calculation, and there's a published paper on exactly this, which actually comes up with 8 percent, in fact, and I can refer you to that.

But the number is small simply because you don't have to move much of the light from one part of the red portion of the spectrum to another.

Now, I should say if you designed a lamp, you could design a lamp that's very poor. So, you know, the lamp manufacturers have sort of two efficiencies.

One is the efficiency of the bulb, itself, and the other is the efficiency of the tailoring of the spectrum.

So, I think that may be the difference. It may be that Philips, in a version that they did, had a 17

percent difference, but it's not a physics requirement.

MR. BENYA: Lorne, Jim Benya, a quick question for you. Could you comment on the difference between CRI, as we've used it over the number of years, and some of the discussions about the new CRI with the additional colors?

MR. WHITEHEAD: Yeah, absolutely. So, the CRI works fairly well. The reason that we would like to improve it, and there's an intention to improve it. But, of course, until that happens it won't be official.

But as Jim has mentioned, the intention to improve it really relates to the upcoming use of narrow-band LEDs. So, these are light sources that are almost laser-like in their narrow spectral distribution.

And it's actually possible to make quite a good lamp with these sources, as I'm sure you know, Jim.

But the difficulty is if you do so, there are slight errors in the CRI reading. And manufacturers find that upsetting because they like to have a number that they can rely on.

So, we're aiming to fix that and, actually, the fix is coming along quite well.

I was just at a meeting in Washington last week where there's more or less agreement that we have it fixed. But it will be probably another six months

before the CIE can approve that.

So anyway, it won't affect our discussion today. But what it will enable is manufacturers to more confidently move forward with what you've described, and that's actually the next wave of efficiency when it comes to achieving the high color rendering.

MR. SHIRAKH: Cheryl English.

MS. ENGLISH: Cheryl English, Acuity Brands Lighting.

I just want to thank the Energy Commission and the contractors for the opportunity to review and discuss these proposals today and for the previous workshops.

I think my first concern is just a general concern that Title 24 has always done a really great job at allowing designers to have flexibility and choice, and designing a building the way the end-user wants that particular building and the lighting within that building.

What's being proposed on this residential standard is very, very prescriptive now. It does not allow the degree of choice that there was in the past. And that's, you know, with everything being high-efficacy.

And so I want to make it clear that I certainly

support the high-efficacy lighting in homes. I am concerned that we're now saying that all the products have to meet a certain criteria and consumers like choice.

You know, when I got in -- I have to equate this to buying shoes. Maybe that's the only thing I can relate to these days.

But I don't want to go in and have to be forced to buy shoes that are necessarily comfortable if I'm looking for a certain style.

And I think the same thing's true in a person's home. They know what they want in their home.

And so with LED, I think the improvement we've made over CFL is that we now have consumer information. So, all the products have lighting facts labels. The consumer is aware of what the color requirements are, what the warmness or coolness of the color is. They know what the energy efficiency is. They know what the brightness is. They know what the power is.

And I think that as a consumer they will make different decisions based on their interests. So, they may be more interested in the energy efficiency and willing to compromise color.

They may compromise color in a garage or outdoor lighting, rather than in their bathroom, where they want

high color.

And so, I would really rather see this move forward to promote quality. And I agree with some of the previous comments that I think quality has been taken significantly out of context versus the research that's been cited.

But I think perhaps there's a better way, through Title 24, to make sure that the consumers are informed during the construction process of their options based on the lighting facts labels of the products that have been accepted or proposed on that project. So that the consumers know what they're getting up front and decide do I want different color? Do I want to compromise here?

There's been a lot of discussion about adoption of the products. And the data from the McKinsey study showed that cost and quality were essentially equal.

And so I think that means that consumers need to make that choice between the cost and the quality aspect.

Because all of the things we're talking about here will drive up cost, even if you get down to adding labels, or changing the way we mark a manufacturing date. That's going to cost.

Flicker tests are going to cost. Life tests are

going to cost.

This is actually changing your cost model of what you've presented because those cost models are not based on all of these things.

And I'm glad this slide's up. All of the things being proposed here relative to the testing requirements that are going to have to go on that don't necessarily exist today.

I'm also a little perplexed because in the discussion we talk a lot about lamps. And it just appears to me that a lot of the data that's being mentioned is based on screw-based lamps or screw-based down lights or even just hard-wired recessed down lights.

But there's a lot of products that go into a home that are not those types of products. So, you've got the strip lights in the garages, you've got sconces, you've got a whole variety of bathroom fixtures.

And so I'm just concerned that we might be making decisions on data that's being driven by lamp data or by down light data, and not really representative of the full home.

On the labeling, I mentioned the lighting facts. I would suggest that you consider a method for inspection with JA8 that doesn't necessarily require a

label or marking on the product.

I think that some products it's going to be very difficult to add that kind of label. Consumers hate labels on down lights because they're distractive.

And so I think that, you know, the spec sheets can certainly validate that a product would meet the JA8 requirements and I would highly encourage you to consider that.

With regard to JA8, I'm still very confused because we talk about this being technology neutral. We've removed LED from the title of JA8. And, therefore, it appears to me that JA8 applies equally to CFL, linear fluorescent, HID, LED.

And if that is the case, the requirements in JA8 will preclude everything except LED because so many of those are LED-specific.

A linear fluorescent strip light, used in a garage, which has a high efficacy, will not meet the JA8 requirements.

And, quite honestly, I don't know of very many people that would care about a 90 CRI in a garage, unless it was a specialized garage.

Also, I'm concerned that it now appears that the high-efficacy is going to apply to the LED outdoor products and that was an error in the 2013 code that was

corrected. And it looks like we're now going back to the same problem.

And I don't think that 90 CRI was intended to apply to the outdoor products.

The Penn State study that was mentioned, it is unfortunate that we didn't have these materials before this morning. I'm not completely familiar with that study, but I believe that that study is really based more on a very narrowly designed product for specific applications with optical brightening agents.

And I don't think that the results from that particular study are universally applied to a residence. I think they're really geared more to retail or spaces where people are making selection based on colors.

Certainly, the whiteness preference is something where you actually have to have optical whitening agents in the materials you're looking at.

So, I don't believe that that study really applies to what you've mentioned here.

And then on the last part of Title 20 there were a number of questions about Title 20, and we have actually not had any official meetings, yet, to review or discuss what is being proposed in Title 20.

So, I am quite concerned about the year-end deadline since we don't really know what's being

proposed for Title 20 at this point.

So, thank you very much.

MR. SHIRAKH: Thank you.

Any reactions to Cheryl's comments? Jon McHugh.

MR. MC HUGH: Thank you. And thank you, Cheryl, for your comments.

I think once you take a look at this proposal, especially when you're looking directly at the code language, I think many of your concerns will be addressed.

First off, linear fluorescent tubes are not required to meet JA8, nor are lamps that use the GU-24 base, nor are integral light fixtures.

So, for your outdoor light, you know, as the example for the outdoor light -- or the shop light, you could still use your standard fluorescent lighting system.

For outdoor lighting you have the opportunity to use either an integral light fixture, a fixture with a GU-24 base, and also all the HID sources that are also allowed in that Table 150.0A.

So, there's a lot -- and I'd just like to point out that, you know, Gary Flamm had done a great job in creating a structure for us to build upon. So, we basically took that structure from last time, which is

quite simplified from before because it describes a number of deemed, you know, high-efficacy products. And now we're actually expanding the breadth of JA8 so that it isn't particular technology -- so that it is technology neutral.

MS. ENGLISH: Okay, I don't think an R-9 value is technology neutral. None of the fluorescents will meet that requirement.

MR. MC HUGH: Yeah, so it's technology neutral in that it's a performance requirement.

And as I pointed out just a second ago, there are a number of ways that fluorescent lamps can comply through that Table 150.0A, which allows for linear fluorescent, GU-24 and, you know, so those are the ways that fluorescent, the existing legacy products can still comply.

MS. ENGLIGH: Okay, I'll have to take that offline then, because I don't read it that way.

MR. SHIRAKH: My understanding is, Cheryl, and correct me if I'm wrong, we're not taking away any of the existing options. You know, anything that worked for 2013 standards, the light sources, the fixtures, the hard-wired stuff that can also continue until 2016.

What we're doing is we're taking a leap of faith and allowing high-efficacy sources that are Edison-

based.

Now, for those, you know, we are concerned because that can be so easily removed. We're concerned about persistence of the measure. So, we're insisting on high-quality stuff because, you know, if it flickers, if people look green, if people can't dim it, they can so easily unscrew it and put a different light source in it.

So that's basically the difference between 2016 and 2013 standards.

MS. ENGLISH: Okay. And I appreciate, you know, the consideration at this point in time of the screw-based because it has come a long way in the last three years.

Just to be clear, so if I have a linear fluorescent wrap fixture that has a 70 CRI I can label it JA8?

MR. MC HUGH: No, no, no.

MR. SHIRAKH: No, JA8 only applies to the screw-in, high-efficacy sources.

So, if you have a hard-wired source that does not need to comply with JA8.

MS. ENGLISH: So, I'm sorry, maybe I'm just being completely dense, but JA8 --

MR. MC GARAGHAN: There's a table we could pull,

maybe.

MS. ENGLISH: -- only applies to screw-based products, whether that's a screw-based down light retrofit or a lamp. Not fixtures, not LEDs with integral boards, or not linear fluorescents, or not CFL.

MR. MC GARAGHAN: It applies to any product that wants to comply as a high-efficacy source that isn't specifically called out in Table 150.0A, which we could pull up and it might help if we look at all the options.

MR. MC HUGH: That would be extremely helpful.

MR. OWNBY: What slide?

MR. MC HUGH: It's near the end of the presentation.

MR. MC GARAGHAN: The Slide 40. So, this is the table that defines a high-efficacy light source and it includes everything that used to be there, linear, fluorescent, compact fluorescent with electronic ballast, pulse start metal halide, HPS, GU-24 sockets, luminaires with an integral light source with an efficacy of 45 lumens per watt.

What's changed is that now there's an additional item here that anything that complies with JA8 is also a high-efficacy light source.

MS. ENGLISH: Luminaires containing lamps or light sources which comply with Joint Appendix JA8 and

the light sources are labeled as such.

So, taking that directly as it's written there, it seems to me that a linear fluorescent --

MR. MC GARAGHAN: A linear fluorescent is identified in Item Number 1.

MR. SHIRAKH: Number 1, so anything that's on that list.

MS. ENGLISH: But they're exclusive.

MR. SHIRAKH: Anything that's on that list is a high-efficacy source, including pin-based compact fluorescents.

MS. ENGLISH: So, there again my linear fluorescent strip light with a 70 CRI --

MR. SHIRAKH: Yes.

MS. ENGLISH: -- is high-efficacy.

MR. SHIRAKH: Yes.

MS. ENGLISH: Okay, thank you.

MR. SHIRAKH: Now, again, we understand the intent, we understand your concern. We may have to massage the language to make that clear.

But again, what I'm trying to emphasize is that anything that's a high-efficacy source under 2013 standards will continue to remain. I mean, that's information for both manufacturers and builders.

MS. ENGLISH: Okay.

MR. SHIRAKH: If you're worried about product availability, you can continue doing what you're doing now.

MS. ENGLISH: That was my concern when you say that there's broader product availability --

MR. SHIRAKH: What we're doing is we're providing an additional option of Edison-based as high-efficacy source. And we want to make sure that these are high quality stuff so people do not have an incentive to replace those.

MS. ENGLISH: Got it.

MR. SHIRAKH: Otherwise, you can continue using your existing products.

MS. ENGLISH: So, we'll work with the contractors where we think that there might be some misinterpretations to see if we need to tighten up that language.

MR. SHIRAKH: Exactly.

MS. ENGLISH: Right.

MR. SHIRAKH: I'm going to take a few more questions then I'm going to move on.

I think Mike Siminovich or --

MR. SIMINOVICH: Well, I'll let --

MR. SHIRAKH: Okay, could you come up to the podium?

MR. SAFARIKAS: Al Safarikas from CREE.

First, I would like to thank the Commission for some progressive rulemaking, also for what appears to be what I hope will be a simplification of Title 24 language.

And I'd also like to echo everybody else's comments. It would have been nice to have seen this earlier. Certainly, the comments would have been more thought out.

MR. SHIRAKH: Yeah, I apologize for the late posting, but these were the same -- generally the same presentations that were made available at the stakeholder meeting that was held last month.

But I think the criticism is valid and we'll try to do a better job. Thank you.

MR. SAFARIKAS: Before I get to the other comments I want to follow up. I would encourage the Commission to apply this to everything, including pin-based linears, screw-based light bulbs, everything.

If we are actually trying to improve and to build a high-efficacy standard for high-quality light, as well, let's go ahead and do it.

Consumers care about light. We have -- you've pointed to the McKinsey study about light. Our studies have shown it.

And it's not hard. Just go to retailers' websites, whether it's Amazon, Lowe's, the Home Depot and read what people say, and code what they say. You will see their number one concern when they're purchasing a light source is the light.

Consumers aren't stupid, right. They're spending money to buy light. They care about light.

And anyone who tells you otherwise, right, is either underestimating consumers or something else. Consumers care about the light.

Now, also let's be very careful about the language that they use. They're not professors at universities. They're not physicists, right, they're not scientists. So, the language they use is not precise.

When they speak about a light bulb, right, they talk about the light. They'll speak of light color. Does that mean light color rendering? Does that mean the color that they see when they look at the light bulb until they're eyes mess up and they can't see anymore?

Does that mean how that light bulb or light source spreads the light?

The answer to that is yes, for all of them. Consumers care about light. They care about its brightness. They'll comment on its brightness, this one

is bright. This one's not bright enough. This one is the color of what I'm replacing. This is what I expect it to be.

When they buy a light source they care about light. Furthermore, right, they care about how that light source looks. They care about appearance.

They don't like it looking weird. They'll tell you that thousands and thousands of times, if you care to read what they have to say.

You don't need any fancy studies. The internet helps. Go onto a website, pick Amazon, Home Depot, Lowe's, whoever else allows consumers to speak their minds and read, codify, it's there.

You will hear manufacturers, and understanding full well that I represent the manufacturer here, you will hear manufacturers talking about the tradeoff between quality and price.

Here's something else consumers don't care about. They don't care about your problems, manufacturers. Consumers want both quality as they define it -- they care about the light. Consumers care about what they buy.

They want both. They want a good price, fair. And you know something, they vote with their dollars. They go out and they buy products.

So, to all of the manufacturers in the room, to all the manufacturers who are listening on the phone, look at your sales; are consumers voting your way?

Do you have a product that meets their price points? And, yeah, lower price they'll buy more. They don't care about your problems about tradeoffs.

And as far as efficacy, I encourage the Commission to set efficacy to at least where it is today, to where technology allows it today.

Manufacturers who talk about tradeoffs, here's my word to them; innovate. Innovate in your engineering. Innovate in your science. Innovate in your marketing. Do not spend time obfuscating progressive standards. Thank you.

MR. SHIRAKH: One question for you, what is your take on the high power factor that's being proposed?

MR. SAFARIKAS: It's fine. It can be met. It's met today. There are plenty of products out there that meet it today.

There are yesterday's products that are masqueraded and pretending to be modern products that don't meet it.

There is no reason that a product that has been developed in the last two to three years can't meet these standards. None.

MR. SHIRAKH: Thank you, sir.

Noah Horowitz.

MR. MC HUGH: Actually, I had one more question here.

MR. SHIRAKH: Okay, Jon, make a comment and then Noah.

MR. MC HUGH: Yeah, I just had a question about the uptake of LEDs in California relative to the rest of the country. We heard from Philips that California is lagging behind the rest of the country. I was wondering if that's your experience, as well.

MR. SAFARIKAS: That is our experience. That was a very accurate comment made by Philips.

And we should not confuse the reasons, at least the reasons we interpret for why.

What has happened is the voluntary quality specification was put out but the utilities were not able to fund at proper levels.

What we have seen and as was shown earlier in the McKinsey study, consumers care about two things. As I mentioned myself, they care about price and they care about quality.

If you can sell -- if you can drop the price through a rebate, in Connecticut, to $4 or $3, and in California it's $9 that's significant enough.

Now, what I chose to do, what CREE chose to do is to drop our price for the California-compliant bulb, ourselves. We had our first voluntary -- it's not really voluntary, it's a competitive market. Any manufacturer that wants to sell product to consumers that care about quality better make sure that it meets their price points.

So, adoption in California is actually trailing behind other states that have very aggressive utility rebate programs.

So, California needs to meet national standards there. Or at least, if you've got progressive technical standards, have progressive utility rebate standards.

MR. MC HUGH: Thank you.

MR. MUTMANSKY: This is Michael Mutmansky with TRC. I've got a follow up for that as well, so if you -- don't leave the podium there.

You know, so one of the issues that we've discussed at length in a variety of situations is the idea that LEDs are replacing compact fluorescent lamps.

Is there any information that you've seen that supports that, you know, it's generally believed that California has a higher CFL -- in-socket CFL base than a lot of other states, as well.

Is that taking away from LED sales for Edison

screw-based products?

MR. SAFARIKAS: The only information that I have is anecdotal. I think LEDs are replacing both incandescents, and I include halogens in that, right, as well as fluorescents.

And that is based on consumers writing us and saying we love your product or we think you can make it better. And they usually tell us what they replaced. We don't ask them, they just tell us.

Other findings that are told to us by our retailers is people tend to buy one or two and then come back and buy a lot more.

Consumers write saying I have umpteen of your products in my home. Thanks for coming out with the 100-watt replacement. Thanks for coming out with this.

They tend to replace both. And I think what is replaced where depends on what kind of bulb.

Is it a reflector? Is it a BR type? Is it a PAR that's being replaced? That's going to probably be a halogen.

Is it an omnidirectional A lamp? You know what those usually are.

So, that's the information I have there.

MR. MUTMANSKY: Thank you.

MR. SAFARIKAS: You're welcome.

MR. MC GARAGHAN: Can I make two additional comments.

Mike McGaraghan. Let's keep the comments short because we are about an hour late. But go ahead, Mike.

MR. MC GARAGHAN: Okay, so two quick comments. First, I also want to say I appreciate all the comments that we've had today. They're all helpful and I look forward to following up with people.

On the issue of product pricing, we have been taking a look at that and the news is encouraging. We've been tracking online sales. And as everyone knows, LED prices are coming down very quickly.

High CRI products are sort of the new thing. They are more recent introductions to the market. Their prices are actually higher, but coming down faster.

So, in just a five-minute -- sorry, not five-minute, five-month -- that would be great. In a five-month analysis of online pricing, the general population -- or I'm sorry, the 80 CRI population of prices came down 15 percent and the price of 90 plus CRI lamps came down 18 percent.

So, they're actually -- if you trend it out, they're catching up. And a code that requires that level of performance for all products would only speed up that price decline for the higher performing

products.

That's all, thanks.

MR. SHIRAKH: Noah, please.

MR. HOROWITZ: Sure, Noah Horowitz with NRDC, the Natural Resources Defense Council.

We strongly support the proposal that the IOUs have made today, with input from many stakeholders.

And as we understand it, it will require a high-efficiency or high-efficacy light source for all applications, which is a shift from the current standard.

And it does allow removable bulbs that go into screw-based sockets, provided they meet the high-efficacy requirements, and also meet high quality, as part of the discussion is how do you define high quality and what's high enough?

We think that will provide a lot larger savings than the current standards were often the compliance path is simply to install an inefficient rotary dimmer that may or may not be used, and also allows half the watts in the kitchen to be inefficient, and so forth.

So, we think this shift will result in a lot more savings. This was modeled by the proposal.

Again, the leap of faith is you're putting in a removable bulb. Will that stay there or will it be

replaced by an inefficient one? And that's why we need to make sure a consumer has a good experience.

And I'll talk through some of the remaining issues. We also support the requirement or the special treatment, if you will, for the down lights or recessed cans where one is not allowed to put in a screw-based lamp. And we think that is the right policy because those are very hot, high temperature environments and the heat management is often better when you have an integrated solution.

And also the concern for bounce-back and lost savings is much greater there.

While we referred to the 2018 or the Federal standards, that's for regular A lamps, if you will. The directional lamps are not covered by those standards. So, you could replace that LED or CFL with a 65-watt bulb.

And the "tend" in the industry is more cans are better. So, we're going to see increasing amount of cans. And this is the part that's essential that we get right. And we think the current proposal does that.

So, at the high level we need to make sure the high-efficacy light source actually gets installed, remains at the time of occupancy, and after the occupant goes in we're hoping it stays there, and that they like

it, and don't take it out.

So, I've got a couple of thoughts and solutions, proposed solutions here.

So, what are the issues that we need to address besides efficacy to make sure the consumer likes it and doesn't replace it?

Many of these are already in the proposal and I'm simply reiterating them. But we need to make sure there isn't objectionable flicker, hum or noise.

We need to make sure they like the quality of the light, whatever that means, and we know that's complicated. It's CRI, but it's other metrics as well.

If it's offering dimming, it needs to dim and offer good dimming. Not only at 100 percent light output, but as you dim it you shouldn't start to get the flickering and humming that some combinations of dimmers and light bulbs provide.

And we need to make sure the thing doesn't die prematurely that you're actually getting the savings.

If it's a highly rated bulb, but because of the application it's put in it dies in a thousand hours, then we didn't get the savings we thought we were going to get.

So, some of our recommendations are we do need to include requirements, minimum requirements for

flicker, hum or noise. And those testings should be done both at full light output, but also when the bulb is dimmed. And the proposal is to do the testing at 20 percent of rated light output. We think that makes sense.

I don't have the solution here, but this is a system. We need to figure which dimmer is the testing done with because each bulb may or may not perform well depending on the dimmer that it's tested with. We want to make sure it's not some obscure dimmer that won't reflect what's happening in the field.

Another issue is certain fixtures will operate or cause an elevated temperature environment. So, that's recessed cans where we already have some requirements, but there are also various enclosed fixtures in the home, whether it's a jelly jar, or it's a globe, or some sort of ceiling fixture that has a glass enclosure over that.

If you notice in the market, I'm one of those people that obsessively does mystery shopping at Home Depot and Lowe's and actually reads the fine print. And most of the LEDs on the market today have a disclaimer, "not for use in enclosed fixtures".

So, if you put a regular LED, even if it's Energy Star, put it in there that may die prematurely or

have accelerated lumen depreciation.

So, we think the solution for that is for those fixtures that are enclosed we require the testing be done at high temperature. And maybe there's a special rating that says HT, or whatever. A label will designate that this bulb will indeed work in this high temperature environment.

One place where we might respectfully differ from the proposal is for those fixtures that are not high temperature that we don't have to do the testing in the high temperature environment, and that might also reduce the manufacturer cost.

We should also think about do we have requirements for the dimmer, itself? How do we make sure that that dimmer will work with today's low power, high-efficacious light sources?

And that gets into the question earlier about, oh, how you do the testing relative to dimmers.

And SSL-7 is out there and there's some incorporation of many of those elements and we should just collectively look through that to see if we're getting this right.

Then we get to some of the details. How is this actually going to work? Philosophically, at the high level it seems like this is a simplification. And I

think that's good for all of us as long as we get the savings.

How will it actually work in the field? So, there needs to be some sort of label. If you just look at the bulb, how do you know if it's efficacious, let alone what it's CRI is, what it's start time is, all that. So, this meets California's requirements.

Is it T-24 CA, whatever the language, as small as possible, as few labels as possible, as needed, sympathetic to the industry's concerns here. I'd like to hear from them how we can achieve this.

So, the inspector can look at it and know, at least due to the claim this bulb is claiming to meet the requirements.

We should also reserve money and the ability to do off-the-shelf follow-up testing to make sure these products are meeting the requirements.

It's great to have a bunch of requirements on paper, but we need to make sure that companies aren't simply putting on the label and undercutting those manufacturers who've spend the extra time and money to do it right.

In terms of creating a registry, will a manufacturer have to register its product under Title 24 or possibly Title 20, later, to show that it met that

label? How would that work? And at what point in the product cycle is it good enough to get onto the list?

Is it 5,000 hours of testing? Is it just 1,000 and then you register later?

We say we have a 15,000-hour requirement, but I don't think we're requiring testing to that point.

So, just to clarify the time sequence would be useful.

We agree with the proposal that a schedule should be prepared. Here are all the bulbs and fixtures, depending on what combination you use to comply.

And that should be provided to the building inspector so they can look at the time of the inspection is it there.

And then also, just as important, the consumer receives this schedule. So, they're supposed to get, you know, these hypothetically 28 different LEDs and five CFLs all that meet the California requirement. But when they look up they're all incandescent reflectors. What happened? And that could help with potential enforcement.

In terms of CRI, I think that's probably the most contentious issue here. And in terms of do the -- what percent of products meet all the requirements? I

think it's CRI that is bringing that number down and further dialogue is needed there.

In terms of NRDC's position, we think it does make sense to have some sort of CRI requirement. And we encourage the CEC to review the costs and benefits with the different stakeholders to determine if the number is 90 or some alternate number.

We should also be forward thinking in terms of color quality standard, CQS, which might be the successor to CRI. If we can't -- if the timing doesn't match up for the 2016-17 code, maybe we can do that next time. And that provides even more colors in the testing that's done.

Finally, a comment about test procedures, yes, everybody would like to have a pedigree test method.

Institutions, like ANSI, have very rigorous processes which are generally a good thing, but they're also very, very slow.

So, there are some cases where one needs to develop a test method that's ideally consensus, but it might not have gotten through the processes.

Energy Star has many times, with great success, developed their own test method or borrowed something from others, even though it didn't have the pedigree of ANSI, or ASHRAE, or some other group, and then later it

goes through the ANSI process and they update it.

So, the fact that something doesn't have an ANSI marking on it I don't think should preclude that test procedure from being included or slow down our process here.

So, lastly, I think in terms of the metrics that we're using and the test methods, we should harmonize wherever possible with the testing that's being done by Energy Star, because industry in most cases is doing the testing already. Let's not require a slightly different test that's duplicative and adds cost.

So in summary, we're very supportive of the proposal and there are a few remaining details that we hope the CEC and others can finalize.

Thank you.

MR. SHIRAKH: Thank you, Noah. Since we're kind of running over our allotted time for this, I'm going to ask people if they have any new comments that has already not been made, or has not been answered to make those comments.

Also, if I don't get to all the comments, we're going to allow write-in comments until July 11th, COB Friday.

MR. OWNBY: We do have two online people who would like to comment, as well.

MR. SHIRAKH: We'll try to get to two more comments in the room and then move on to a few comments online.

Sir, somebody here, I saw a hand. Please, go ahead.

MR. BOESENBERG: Alex Boesenberg, Manager of Regulatory Affairs for the National Electrical Manufacturers Association.

I'd thank the Commission for having the meeting and I want to thank the IOUs for setting up that stakeholder webinar and website. We appreciate that. We would like to be more involved as early as possible. We'll be involved now and stay involved.

I want to specifically address what I think is a fundamental misconception stated earlier by Mike McGaraghan and Mr. McHugh about the Energy Star test procedure for flicker.

As the commercial lighting representative to Energy Star, on behalf of my members we were deeply involved in Section 12 of the Energy Star Lamps Version 1 specification, and we were distinctly opposed to the establishment as a flicker requirement, as it stands in there. And some compromises were made.

And what has not been mentioned today and is extremely important to the Commission is the fact that

12.3 in the Lamp spec, flicker, the test method is voluntary. It is performed by the manufacturer, self-reported to EPA for a future consideration of, well, did it work or not, we're in a -- we're not sure if it works, but we're going to try it and see what happens.

And fundamental to that agreement is the fact that Energy Star's third-party certification bodies are not performing that testing. It is not being performed for verification testing. It is currently not an enforcement measure.

But if you put it into Title 24, it becomes an enforcement criterial.

And the fundamental issue there is repeatability. And that's where an ANSI standard gives us that level of comfort we want.

Every manufacturer performs flicker testing. Every manufacturer, in their test lab, have their own procedure, whether it's the Energy Star test method or their own, and they have their guy with the golden eye who decides it's good enough for their customers.

What we don't have is a procedure that you can hand to someone who's never done it before and get a consistent result with someone else. And that is why we're still currently opposed to a flicker requirement in Title 24.

It is not that we don't want quality products and it's not that we aren't trying to produce quality products; it's that what happens when you get sued? What happens when the Commission wants to yank your certification? But I tested it, I did fine.

That's where the standard provides you that level of comfort that we are working towards. It's not ready, yet. Sorry about that.

But when you're staking your reputation, and rebate dollars, and consistency on it, you need to be sure.

Thank you.

MR. SHIRAKH: Thank you.

Go ahead, sir. Again, I ask you to limit your comments to topics that have not already been comment on. Thank you.

MR. LIEN: Glad to do it. Mark Lien, with Osram Sylvania, and I'd like to thank the Commission for having this. This is a great forum for discussing lighting.

My first question is does the CEC lamp quality spec cease to exist since Title 24 is incorporating JA8, they're incorporating it into JA8, along with the new Title 20 and Energy Star specs? So, what's the future for that?

MR. SHIRAKH: Do you want to take that, Jon?

MR. MC HUGH: I'll actually have Mike do that one.

MR. MC GARAGHAN: So, it shouldn't conflict with that. The voluntary spec is specifically around rebate eligibility.

MR. LIEN: Right.

MR. MC GARAGHAN: And if high-quality, high-efficacy sources become a compliance option in Title 24, they're still not -- it's still not a requirement in shelves and stores.

MR. LIEN: Okay.

MR. MC GARAGHAN: So, our operating assumption is that those are separate arenas and that the quality spec would still be used by rebate programs.

MR. LIEN: Thank you for the clarification.

There was a mention of a comment that had come during the May meeting on expanding the color temperatures to accommodate the lamps that warm when they dim. And there's obviously a lot of LED fixtures that do this, as well as lamps. Some of it's, you know, health benefits, you're getting red and going amber as they dim.

Is that being considered at this point?

MR. MC GARAGHAN: Yes, that was a great comment.

We agreed completely and have adjusted the language specifically to accommodate those types of products.

MR. LIEN: Terrific. And the T-8 LED replacement lamps, how are they addressed in 2016? They didn't exist when 2013 was written and we've had some confusing comments about how they are addressed from 2013, from the CEC so --

MR. MC GARAGHAN: So, that's a great question. I think, by my read of the way this table is laid out at this point, an LED tube lamp would have to meet JA8.

If you have comments on that approach, we'd love to hear them.

Currently, Number 1 is the only linear -- you know, linear product that doesn't have to meet JA8 and that specifies fluorescent.

(Off-record comment)

MR. MC GARAGHAN: A linear fluorescent does not have to meet JA8. It can be installed and would meet -- and would be a high-efficacy source.

A linear LED tube, I think the way this is structure so far is that it would be -- the only way it could comply is if it meets JA8.

MR. LIEN: Okay, and linear LED tubes currently, in 2013, do they -- are they a modification in place where it says that if you change the source of the

luminaire it qualifies as a modification in place and triggers the Title 24 requirements under that?

MR. MUTMANSKY: This is Michael Mutmansky with TRC.

So, you've crossed over into nonresidential, now, and so --

MR. LIEN: Fair enough.

MR. MUTMANSKY: -- those issues actually fall into that category. So, I think we don't have to actually address that retrofit or replace, you know, situation here.

MR. LIEN: Understandable.

MR. MC GARAGHAN: This afternoon.

MR. LIEN: This afternoon, thanks.

MR. SHIRAKH: Dave Patton

Was there any other commenter back there? I saw a hand. We're good so, okay.

MR. PATTON: David Wilds Patton with David Wilds Patton Lighting Design.

I'm feeling a bit betrayed because in the May meeting that we had it was my understanding that what we were looking at were all of the non-high-efficacy fixtures.

And now, what seems to have happened is we've slipped in recessed fixtures and just sort of patently

said that they're going to now have to be high-efficacy.

And I think that there's a -- I think there's still a better opportunity. What do we do about bipin MR-16s, for instance? I think that's a lamp that's one of a kind.

And granted, I think that there are even some bipin sources that can replace those, but even DOE doesn't really like any of that as far as the quality goes, yet.

So, where do we stand in terms of flexibility in recessed light?

So, I disagree with patently including recessed lights or excluding recessed lights as part of this. I think that having screw-based A lamps and bipin MR-16 replacement lamps is important.

And part of the reason being that what if we end up with less than 90 CRI? What if we end up with a poor CRI product, but it has to be an integral product? Then, I think we're getting the worst of everything.

MR. BENYA: David, Jim Benya. I think I'm going to stick with Noah on this for thermal reasons. But on the other hand, I think you're bringing up a very important point.

And one of the things I want to stress is that everything that's said here today gets considered as

staff takes these all into consideration and comes forward with proposed language.

MR. PATTON: Right.

MR. BENYA: So, just because it's up on the screen right now doesn't mean it's going to survive exactly the way it looks right now.

MR. PATTON: Which is why I have to stand up here and say something about it.

MR. BENYA: Right. So, you know, you're making a point that is -- as you know, I do similar work sometimes to what you do, and I'm very familiar with the MR-16 and I use it a lot, myself.

MR. PATTON: Uh-huh, we're outlawing it.

MR. BENYA: Pardon me?

MR. PATTON: We're outlawing it.

MR. BENYA: Yeah, so we're --

MR. PATTON: And other bipin lamps, what about the other ones?

MR. BENYA: Well, I'm just saying the MR-16 actually was mentioned earlier, a couple times.

MR. PATTON: Right.

MR. BENYA: There's a lot of different light sources with different bases, different sizes, candelabra bases, and you name it, there's a lot of stuff out there.

MR. PATTON: It doesn't exist right now in the --

MR. BENYA: And I think we have to take that under advice and do some more thinking about some of those.

I think the emphasis of the CASE team so far has been the large volume, mass-manufacturing of residences.

And as you and I both know, many times the fine points of higher quality lighting design often get overlooked.

I can promise you that we're not going to overlook them.

MR. PATTON: Yeah.

MR. BENYA: So, your point's well taken. We'll keep that in mind and try and make it real clear.

MR. PATTON: Yeah, I just -- I don't want to be betrayed on this.

MR. MC GARAGHAN: And a follow-up question, David, you brought up the recessed can, specifically. The way the proposal is right now, the recessed can would have to meet JA8, so it would be 90 CRI.

Is that --

MR. PATTON: What do you mean?

MR. MC GARAGHAN: Well, if it meets JA8 that means it is 90 CRI. And I thought your concern was we

could accidentally end up with recessed products that are less than 90 CRI.

MR. PATTON: But I'm also hearing a whole 'nother faction that says that they want to cut that down, too.

And so my biggest fear is that we will go down this road of not -- in a way we can keep -- we can keep manufacturers honest by being able to put a bipin MR-16 back in the can and say it didn't work. I tried eight different fixtures and it doesn't work.

But if we're instead saying that we're stuck with whatever is integral to the fixture, then we're really stuck with whatever the manufacturers decide that they can afford to put out on the market.

And so, I'm just -- I'm not convinced.

MR. BENYA: David, a follow-up question. What would be your reaction to an exemption for low-voltage lighting? Would that cure some of your concerns?

MR. PATTON: It does to a degree. But I even think -- I mean, I -- I've seen the CREE screw-in LED lamps in recessed down lights that seem to work absolutely fine. So, I don't really kind of have a problem with screw-ins in that.

I understand that you're worried about the heat issue and Noah said the same thing. I get it. But I

think the products are out there that can be used to do that.

So, yes, I mean if I had to take it, I'd take it, right. But I still think that we're overstepping.

Thank you.

MR. SHIRAKH: Okay, we're going to go to -- Jon, did you have a quick response to that?

MR. MC HUGH: No, I'll follow up online.

MR. SHIRAKH: Yeah, we need to have follow-on conversations.

Any questions on line, we'll take a couple and then we need to move on.

MR. OWNBY: Okay, I believe we just have two. The first is George Nesbitt. George, I'm going to go ahead and unmute you, now.

MR. SHIRAKH: George, could you please make your comment brief and to topics that have not already been discussed.

MR. NESBITT: Just because everyone else took all the time, darn. Can you hear me?

MR. SHIRAKH: Yes.

MR. NESBITT: Okay, George Nesbitt, I'm a HERS rater.

I've been working with homeowners for over a decade and a lot of people are bleeding to death because

of lighting. And the gentleman from NRDC almost hit it on the nail, it's all about more. More light fixtures, more recessed lights. You can't walk into a kitchen that doesn't have 20. The master bath has 10. The master bedroom has another 15 or 20.

And I think what we're failing at is lighting has been mandatory. Yes, we're making it more, more requirement. You must do this here, that there, 50 percent higher efficiency, and a minimum one in the bathroom, blah, blah, blah, blah.

But you can still put in a hundred efficient lights and waste a lot more energy than you need to.

So, I really think we need to go to a square foot budget. We need, you know, to be able to trade it off.

Just in the HERS rating system we can account for screw-in bulbs. We've been able to do it forever. Lighting controls, high-efficacy, low-efficacy, so on and so forth.

So, I think even though, you know, we're trying to get all efficient light bulbs, we still may not get where we want.

So, that's the one point.

And then just the only other thing I think I'll hit on along that is not every light bulb I think needs

to be dimmable. I have no dimmers in my house. Not every light bulb needs to have high CRI, I mean, and/or controls. So -- and/or, I guess the proposal would be a bulb would have multiple light colors.

Well, let me choose the bulb that has the color I want, the CRI I want for the application.

And I think the other thing is I guess I'm not clear whether our efficacy standards are based on the light -- or the lumen output per energy input, as opposed to the fixture efficiency.

Because I refuse to probably put in most high-efficacy light fixtures in my house because it would mean I'd double my wattage because the fixture prevents a lot of light from getting out.

And so, I have all A-based screw-in, antique fixtures. I can change, you know, from CFL to LED. I can change technology. I can change color temperature. I can change CRI. I can change wattage. And that's, I think, an advantage over an A base. And I do like the fact that an A base is allowable.

MR. SHIRAKH: Okay, can I respond to your comments quickly, George?

As far as going to, you know, whole house watts per square foot, I think this is probably something we cannot do this time, we just don't have the time. You

know, it's something we can consider for the next round of standards when Bob Raymer and I are not around anymore.

(Laughter)

MR. SHIRAKH: And also, on the question of requiring dimmers, we're not going to require dimmers on everything. But what we're saying is -- what we're providing, again, this is an important note, we're providing an option that does not exist now. We're keeping all the current options on the table and we're adding one more that you can put in a high-efficacy source in an Edison base. You can screw it in and remove it in five seconds. And if you're doing that, it has to be a high quality source so it can stay there. So, that's the only difference.

We're not saying that, you know, you have to have a dimmer on every single one of them. You can change them afterwards. It's not impacting products that are on the shelves that are being sold, you know, through the existing channels. Retrofit markets and all of that, you know, it doesn't impact all of that.

So, is there any other -- I have to move on, George. You know, please feel free to send us an e-mail.

I'm going to take one more comment online and

move to nonres. Is there --

MR. OWNBY: Yeah, there is, just a moment.

Owen, you're unmuted.

MR. HOWLETT: Yeah, this is Owen Howlett, and I'm working at SMUD.

The main thing I wanted to say was just to agree with the direction that this effort is going. I think it's becoming clear from the weight of the research that light quality is something that people really value and it's something that we obviously need to do a better job of measuring. But every step taken in that direction is a good one.

As long as I can remember, the Energy Commission has been thinking about this idea of allowing high-efficacy lamps in screw-based fixtures. And there's always been this worry that builders would abuse that freedom and would remove the lamps after inspection.

And I think this idea of using a schedule to give to the homeowner is a very clever way of trying to make that work in a more watertight way. So, I think that that's a great idea. I really support that.

To Bob Raymer's point, very early on, Bob, you made a point about the Federal standards, the ISA standard.

Late last year DOE announced that it was not

going to close any of the loopholes that exist in that standard, which leads me to believe that the effect of that standard in 2018 is actually going to be pretty minimal.

And that leaves a big effort for California to plug that gap, to reach its greenhouse gas holes using some other method, other than that Federal regulation.

So, in terms of reaching those goals, I think this approach of allowing screw-based, high-efficacy lamps has got to be one of the cheapest ways for homebuilders to help to achieve those statewide goals. So, I think this is kind of a win for everybody.

My only concerns are I had a couple of -- well, okay, so I agree with a couple of commenters who said that we need to be careful about specific lamp types, the things like GU-8s, and MR-16s where there is currently not a good high-efficacy alternative to the incandescent.

I would caution that if we carve out exceptions for those lamps, it doesn’t give an incentive for manufacturers to develop high-efficacy options for those lamp sizes.

So, I would urge the CASE team and the Energy Commission to look critically at when those small luminaires and those small lamps are really required,

thus the circumstances in which those small luminaires are just a product differentiation. You know, our product is different, and smaller, and looks different from the competitor. Is it actually providing a different degree of utility versus simply a different appearance?

And should we be letting a different appearance dictate energy policy?

The only other couple of things were I would really like the team to consider light pollution for outdoor fixtures. Because, of course, residential subdivisions tend to go in places where -- places which were previously inhabited by animals. And those animals are then living nearby, adjacent to the subdivision and their habitats are greatly affected by lights going out of the subdivision. So, light pollution which is a problem a lot.

And I think the requirement for dimmers is possibly problematic. Because the way I read it at the moment, dimmers are going to be required for screw-based high-efficacy lamps, but not required for hard-wired high-efficacy fixtures. And that seems a little inconsistent. I think it may be a criticism.

So, you might want to think about also requiring dimmers for the hard-wired high-efficacy fixtures to

make it consistent.

Those are my comments.

MR. SHIRAKH: Thank you, Owen.

And with that I'm going to close the residential lighting topic. You have an opportunity during the public commenting period to make additional comments or you can send us your comments.

Again, your comments should go to the docket and the instructions for the docket are on the workshop notice. And you can send us e-mail, and so forth.

And we ask you to do that by Friday, July 11th.

So, we're going to move on to the next topic. Obviously, I'm going to have to make adjustments to the schedule. We're going to do the next topic and then break for lunch and move the -- we have two topics, nonresidential indoor lighting and nonresidential lighting controls and partial non-occupant sensors.

I think we can -- we may have to move to one of those after lunch. And, hopefully, we can make up time during the rest of the day.

So, nonresidential indoor lighting, Mike Mutmansky from TRC is going to present that measure. Thank you.

MR. MUTMANSKY: Thank you, Mazi.

MR. OWNBY: Give me just a moment to pull your

presentation up.

MR. MUTMANSKY: Okay.

MR. OWNBY: Okay, which of those is that, Mike? Can you see the screen?

MR. MUTMANSKY: Okay, so what we want is -- the second one, yeah, the second one down.

All right, so without further ado we're going to move on to a topic that, as Mazi said, hopefully we can pick up some time on because everybody wants to get to lunch, I'm sure. So, we'll be able to get through this lickety-split.

Nonresidential lighting, indoor power densities is this CASE topic.

This report is very similar or this presentation is very similar to the one that we did in the stakeholder meeting back in May. We've updated a few things, but for the most part it's very similar. So, you should -- if you've been on the previous call, you should recognize most of this.

The basic history here is Title 24 is charged with being at least the equal to other national codes, in particular the IECC and ASHRAE.

In our basic comparison here, ASHRAE 90.1 model sets LPD values for certain indoor, nonresidential allowances somewhat more stringent than other -- than

our allowances in Title 24, currently.

So, we wanted to focus on those and address the differences, if they were possible to do so.

The next slide; so what we set about to do was essentially make a comparison of ASHRAE 90.1, the current ASHRAE 90.1, then look at where our values were, identify opportunities for targeting lower LPD values, and then go about doing the calculations and analysis necessary to actually do that.

This will ultimately affect what's called the area category Method Table, the Complete Method Table, and the Tailored Method Tables. There are several that are in there.

The next slide; so I just mentioned the tables. It's Table 140.6C, which is the area category table method. Complete Building Method 140.6B. And then the Tailored Method, there's several tables for Tailored Method, but the one that we actually impacted is 140.6G. So, you'll see those in there.

The calculations that we did were specifically space-by-space calculations so that most directly applies to the area category method.

And then we took those values and did some extrapolation out to adjust the complete building method tables by doing some composite complete building method

sort of mock-ups, if you want to call it that.

And also, indirectly we used that to do some calibration of the tailored method table, as well.

The next slide; so this is the current 140.6C. And just to sort of have it be familiar to everybody, and it's in the document, I'm not going to cite anything specific on here. It's too small for anybody to read, anyway.

But, you know, here's the standard table with all the allowances going down by area category from, you know, all of the various ones.

The next slide; and here's the complete building method table which has allowances for all of the building types that have all of their own distinct allowance.

And then down at the bottom is a catchall down there, the "all other buildings". It's actually at the bottom but, you know, it actually probably ends up being one of the biggest categories in the entire set of tables in terms of the square footage that gets applied to it.

The next table; these are ASHRAE 90.l representative tables. They actually have some pretty large tables in their document, so I pulled some samples.

On the left is sort of their area category methods; their space types. And on the right is their building types and that sort of matches up with our complete building method.

The next; all right, the typical practice that we have observed in the industry is to essentially go into a space, define what that space is if you're doing an area category method approach, and then determine what your allowance is.

And then you can either -- you can either take that and sort of design up to the allowance and, you know, essentially use up all your watts space-by-space, or through the whole building and do some trading around in the building. Because you're allowed, you know, to swap watts around in the building, as long as you aren't trading between conditioned and non-conditioned space.

But the issue is that a designer -- by doing that, if they're designing based on watts, they are possibly over-designing from a light level perspective.

They're meeting the LPD, but they're really actually delivering more light than is needed per IES design criteria.

So, you know, if you designed a criteria, you should be able to come in under these numbers pretty comfortably. That's the way they were designed in the

first place.

The next slide; however, some of those values, you know, as I said, they were designed to allow you to meet IES criteria. But lighting technology is improving and we, in the industry, now this has happened. And it's been gradual for some lamp types.

High-performance T8 products, for example, have improved gradually over the years. But they were actually a very reasonable improvement over the previous T8 lamps, the old 700 series T8 lamps, et cetera, of the 90s and 2000s.

LED light sources, however, are very rapidly improving. And we're going to see a graph about that here in the next couple of slides.

But one of the things to remember here is due to the Federal EISA law, high-performance T8s are now the basis of design for linear fluorescent lamps, which gained us about a 15 percent benefit over the old T8s from the 90s and 2000s, mostly due to lumen maintenance, but also just due to source efficacy improving.

As LPD allowances -- if LPD allowances remain where they are, as light source technologies improve, the effective net result is LPD allowances become more -- or more relaxed or less restrictive because the technology makes it easier to actually meet a design

criteria.

So, this is why we are ultimately, essentially sort of looking at this as a maintenance upgrade to LPDs in the indoor section to address the fact that things have improved in terms of light source technology. And some of these values have not changed in a while so it's time to update them.

The next slide; so here's the graph that I was mentioning and you can see that things, really other than incandescent and halogen, down at the bottom, which really haven't done much in an awful long time, everything including CFL, linear fluorescent, HID, they're all gradually moving forward, upwards and, you know, we're gaining efficacy along the way.

And as you can see, a couple of segments there are sort of highlight on the linear fluorescent line where T8s started to come into play, and high-performance T8s came in.

And as T12s disappear, that linear fluorescent line is going to continue to drift upwards gradually, over time.

The next slide; and this is the other thing to consider. And we're not actually going to go into LEDs as part of this measure.

But that graph there, which is sourced from a

DOE document, shows that basically by the end of this year, you know, LED luminaires, so this is luminaire efficacy, not source efficacy, LED luminaires are going to essentially, for the most part be beating the best of linear fluorescent and HID luminaires from this day forward.

And within a very short period of time, by 2020 we're looking at a number that's 50 percent or so better in terms of luminaire efficacy. So, things are changing in the lighting industry very rapidly.

We are not doing anything with LEDS specifically in this set of requirements here, this set of change proposals.

The next slide; so our method of analysis ultimately is to establish design criteria for the spaces that we are comparing, then determine reasonable baseline conditions.

And as I said, for the most part these are industry standard sort of design procedures, high-performance T8 lamps.

We're using commodity grade fluorescent products for the most part. Nothing exotic here in terms of, you know, high performance fixtures. These are sort of good quality baseline products, et cetera, that would be specified in very large numbers throughout the State.

Space conditions, we took a slightly conservative number on this, 70-50-20 for the reflectances that would be anticipated.

Many places are doing -- many spaces are specified now with higher reflectance values than these. This is a reasonable, conservative position.

And light loss factors, as well. What we did here was essentially used lamp data and luminaire factors that are essentially the industry standard, and it depends on the luminaire and it depends on the lamp. So, it's all over the map in that respect, but nothing out of the ordinary.

For many of these we ran lumen method calculations because these are general allowance requirements. They're not, you know, very, very focused or targeted allowance calculations. So, these are run mostly with lumen method calculations.

The next slide; moving on to the energy and demand impacts that will be, you know, essentially statewide impacts that benefit the grid, and et cetera, the total energy consumption in the State.

That work is done through spreadsheet analysis. Not through a building simulation because of the way these lighting loads are sort of discretely done in a space, not done through a sort of total building

analysis.

And it has to do with LPD reductions, which are then extrapolated up to statewide impacts based on percentages of square footage of each space type that is impacted in the State based on construction estimates and projections out at 2017.

Then, ultimately, those are taken into the TDV values to determine the total energy and demand impacts that will occur in the State.

The next slide; functional areas under scrutiny, these are the ones that we identified through consideration with ASHRAE as opportunities, maybe, to go in and sharpen our pencils a bit and see what we could come up with.

And I think there's about 18 of them on here. And for the most part what we did is we only targeted ones where ASHRAE was clearly a lower value, something in the order of 10 percent lower.

At that point we said, okay, they're no longer a more or less equivalent value. Because ASHRAE is sort of a half-cycle behind us, if you want to think of it that way, so they just completed theirs not that long ago and we did ours a couple years ahead of theirs.

So, you know, now it's time for us to get back in and do ours again.

Moving on to the next slide; one of the interesting things that we did is we noticed that a number of these values, where ASHRAE was more aggressive, we went back into the old code versions and found the first time that that value was placed in our code.

And I'm going to move to the other screen because I can't see that one over there as well.

But, basically, what we noticed is that a preponderance of those values that are in our current Title 24 allowance tables were actually established in 2001. So, we're talking about values that are, you know, 13 or 14 years old.

Well before high-performance T8s were the di rigueur and we, you know, clearly had some opportunities there.

And it's really what we're talking about isn't a technology, a light source technology improvement, you know, this gradual improvement of fluorescent products over the last 14 years or so, and there's clearly opportunities here.

So, it made us feel, you know, vindicated, I guess, that there are some really -- some real room to make some improvements when we realized that these numbers actually here -- have been around for an awful

long time in their current status.

The next slide; our initial findings were that many of these spaces did have opportunities to reduce the values.

There were a couple of spaces where we couldn't go down and match the ASHRAE values and we came up with a couple of reasons why we thought that was the case.

But, ultimately, it really just comes down to for the most part we think that they have defined their area uses slightly differently, and they may have chosen a different IES design criteria for the most part, for those spaces.

So, you know, we looked at the number that we actually felt, you know, were in very good alignment, and felt that there were a couple of outliers. And I think that we needed to just do what we were going to do and not be matching ASHRAE specifically on any one of these, in particular.

The next slide; so the LPD values are going to change in 140.6, but only for those targeted spaces that we identified earlier. And you're going to see the results here, and we're going to show them here in a little bit.

So, it's not an entire table swap here, it's just the targeted use categories that we had listed.

LPD values in the complete building method table, Table 140.6B, the only spaces -- or the only buildings, now, these are complete buildings. The only buildings that we are actually targeting are ones that have a preponderance of impacted spaces that would have been in that sort of section, that area where we made changes in the area category method table.

So, if we lowered a space type in the area category that -- for a specific use, and that specific use happened to be -- add up to a considerable portion of one of these whole -- these complete building values, then it ended up being impacted by it.

And you'll see that again, we're going to show those to you.

And then the last area is in the tailored method, 140.6G, we did some adjustments to that table to adjust for high-performance T8 lamps because, based on our research, that table was not specifically adjusted for high-performance T8 in the previous code revision, which it could have been, but it was not.

It was right as that whole HPT8 lamp thing happened. So, it didn't get changed and it could have been.

The next slide; so, here are the new values that we are proposing for this, and I'm just going to go

through a couple of them.

For the most part we're talking about minor adjustments. The top one, auditorium area is originally we had, in the current code, a 1.5 LPD. And ASHRAE has a substantially lower one.

That's one of those ones where they clearly are defining this space differently. They are using a .63 watts-per-square-foot allowance for that.

Based on the way we are interpreting an auditorium area, we were able to lower it from 1.5 to 1.4, but we certainly go down to that .63 value.

Most of the rest of the spaces we really didn't have any problem matching their -- matching their values or, our know, our calculations showed that there was room for improvement.

There are a couple, though, where we need to make some exceptions to it. I'm not going to hit every single value here because it's really not important to hit each one.

We can get into details with any one of these, if anybody wants to, you know, offline. But for the sake of time we're going to move forward here.

So, let's go to the next slide. There are a couple of areas where we had, you know, sort of problems when we did the calculations and we basically felt like

we needed to address them sort of specifically.

Auto repair area, no matter what we did we were not able to lower our values from where we currently have them established. So, we are not -- even though ASHRAE is lower, we are going to leave them where they are. We are not recommending a change.

Exhibit area for a museum, ASHRAE uses a different calculation than Title 24, so you can't actually compare them directly.

So, we basically did our best calculation using our -- the method that Title 24 uses, which includes display lighting, whereas ASHRAE excludes display lighting.

And then we did it without the display lighting and then we added in, essentially, a display lighting allowance. So, we have a value that doesn't match ASHRAE but it makes perfect sense once you sort of factor in the display lighting variable there.

We are also recommending that we add an exemption for lighting intended for performance, makeup, hair and costume preparation in dressing rooms that are tied to -- that are tied to performance venues, auditoriums, and stages, theaters and that kind of thing.

Because those light types need to match what you

actually are performing under and that is generally incandescent, still. And those sources for theater lighting are exempted right now, explicitly in the code. They are not counted because, you know, theater lighting is variable. And it's also specifically needed for the performance or aspect of what we're talking about.

So, we felt like if we did that we could lower the locker/dressing room allowance. But if we didn't allow an exemption, then we would have to leave that value where it was.

So, we put an exemption and then lowered that locker/dressing room allowance a little bit.

And the other change that we are proposing is changing from the basic transportation function area category to ticketing area, and concourse and baggage area.

That would allow us to do a much more aggressive concourse and baggage allowance, which is the preponderance of most spaces that are these transportation function areas.

And keep the ticketing area allowance up at the higher light levels that are needed to -- you know, for ticketing requirements.

The next slide so, as I said, once we ran through those calculations then those impacts then were

run down through some of these complete building method tables, as well.

For the most part we're talking about nudges down in the order of a 10 to 15 percent kind of nudge to these specific ones in the table. There's a couple that were not impacted at all. So, you'll see this is not the full table, just the ones that are adjusted downwards.

The next slide; the last table with adjustments is tailored method table. And this is a calculation table that is tied to design illuminants, which the way the tailored method works is somewhat complicated. But it gives you sort of a design criteria that you're allowed to, essentially, in terms illuminants for your general lighting.

And then you take that and you look at this table to determine your LPD for general lighting. And that's related to your room cavity ratio. So, as your room cavity ratio increases, your allowance increases as well.

Those values, as I said, were not based on high-performance T8 before, so these were adjusted based on essentially maintained efficacy of high-performance T8s compared to standard T8 lamps.

So, this reflected about a 10 percent change and

it’s the entire table.

The next slide; so, we have specific code language in here for what the changes are proposed to be. This is the one exemption for essentially makeup and costume preparation for performing arts facilities.

We don’t need to get into the specific code, so we’ll just move on.

The next slide; in the last stakeholder meeting we got feedback from a variety of people and I don’t know that we need to go through every single one of these again for the sake of speed and time here.

But we did want to acknowledge that we heard the feedback and we addressed it or answered it, at the very least, and it’s documented in here.

The next slide; this particular one has one comment on it that I think is worthy of responding to.

The top one, “.7 watts per square foot for equipment rooms is already dimly lit”.

And we wanted -- we responded to that in the previous meeting, but I wanted to just sort of reinforce it that these are allowances for general lighting. These are not allowances for repair of mechanical equipment. That type of an allowance is -- that kind of work is going to require essentially task lighting being brought in. I mean it’s always the way it’s been with

mechanical equipment because of duct work and things shadowing your equipment. And if you have to get inside a piece of equipment to do some work, you don't have any general lighting in there, anyway.

The general lighting allowance is really geared towards providing you with a safe way of finding, through a space, towards the exits, some basic work, like changing a filter on an HVAC unit, that kind of thing.

If you have a specific need beyond that, that's not what we're trying to achieve with these allowances. So, that doesn't ultimately surprise me that it may be perceived as dimly lit. But that's sort of what we're charging with, with these.

The next slide; all right so that's the end of that, maybe a little less controversial. Do we have questions, Mazi?

MR. SHIRAKH: Thank you, Michael.

Questions in the room, I see a few hands, David and then after that the gentleman behind you. I'm sorry, Noah.

COMMISSIONER HAMMOND: My name is Noah David Horowitz, so you're okay on both fronts there.

I have just a few quick clarifying questions. I appreciate the intent of using high-performance T8s as

the baseline and then trying to catch things up to that.

There are a few places where that's not aligning and I understood there were certain unique circumstances in some spaces.

But it seems like there are a handful of spaces that haven't been changed since 2005, and ASHRAE didn't change them.

So, it's the civic meeting, classrooms, restrooms, stairs, gyms and so forth.

And since it was 2005, my question is did we assume high-performance T8s for these spaces and, if not, is there a reason we couldn't catch those up, as well?

MR. BENYA: This is Jim Benya, having been the person who did those calculations then, yes, we used high-performance T8s and we have since the 2005 standard.

MR. HOROWITZ: Okay, then I'm happy and ready for lunch. Thank you.

MR. SHIRAKH: Okay, thank you.

MR. MUTMANSKY: I'm ready for lunch, too.

MR. SHIRAKH: Well, actually, we have one more comment before lunch and then online. Believe me, I'm hungry, too.

MR. MARTIN: I don't want to hold up lunch. I'm

John Martin from the International Association of Lighting Designers.

In the effort not to hold up lunch, the first question I have, Mazi, is I think you mentioned that the written comments would be accepted until when?

MR. SHIRAKH: July 11th. It's a Friday.

MR. MARTIN: So, I have a request to extend that period to maybe the end of July. Think about it.

Just would like to point out that the issue of controls versus LPDs is still a valid issue. It isn't just a matter of catching up as the response on slide 24 indicated.

And certainly our concern, overall, of the lighting design profession is represented by the IALD, has been that the reliance on LPDs can lead to a false sense of energy savings because it's a connected load standard.

So, juggling LPDs can be falsely reassuring and we should be very careful about reducing LPDs to the level that they unnecessarily constrain design, while not necessarily offering the kind of savings that we thing they're going to.

Secondly, I'd like also to point out, just for the record, that there's nothing sacred about IES recommended levels. They, in most -- in many instances,

and I say this with the deepest respect for all the people who've historically, for the last hundred years, been involved in putting those levels together. In many, many instances they are consensus-based and have no -- not necessarily a scientific basis in the impact of the recommended levels on human comfort, productivity or any other metric.

So, relying on IES recommended levels is great as far as it goes, but it should be acknowledged that it's a very imperfect standard.

And finally, I think that it's very important not to get into an LPD race, and not to be saying, just for the sake of, well, we haven't changed this in a while, maybe we should lower it.

Well, not necessarily. Look at what the actual building products are looking like and results that are being achieved, rather than simply saying, well, we haven't changed this, we haven't tightened it in five years, or eight years, or ten years.

If it's the right standard and it's consistently being met or even exceeded, which in many cases in finished buildings it is being exceeded, then reducing it simply to retain parity with ASHRAE, or another code family is not a very wise basis for policy.

So, thank you.

MR. SHIRAKH: Thank you so much.

Any response to these comments?

MR. BENYA: I'll say that I totally agree with John's comments because that's been part of the thinking that's been on my plate when I've had the responsibility to do what's being done now.

I just wanted to say I've reviewed Michael's work and the work of this team and I've been very pleased to see the room type by room type, project type by project type care that they've taken to do -- or to not do exactly what you were concerned about.

I think given the changes in technology and the relatively small changes in the lighting power density values since 2008 standard, I think this is -- we're in particularly good shape here to still allow pretty darn good lighting design to be able to be done, and yet remain energy efficient.

So, John, your concerns are very valid and I think the team has, from my personal stand point, done a good job of showing that restraint.

MR. SHIRAKH: Thank you, Jim.

Any other comments in the room? Cheryl English.

MS. ENGLISH: Cheryl English, Acuity Brands.

Just to quickly reiterate, but I think that the modeling and detail that's been done relative to this

has been very extensive. You know, reserving any right, because it is so massive that there may be some little tweaky areas, but I think it looks very reasonable.

The only area that really was rather aggressive was the concourse, which dropped significantly. But concourses, generally, have a sufficient amount of daylight, as well. So, I think that's a very warranted reduction.

And I just want to applaud the team for the quality of the work.

I also believe that the appropriate energy approach to this is a holistic approach of the equipment, and the controls, and the day lighting. And I believe we'll put it in context that this part of the session is only about the LPD tables and that there will be more discussion relative to the controls, which I also endorse here.

Thanks.

MR. SHIRAKH: Thank you, Cheryl.

MR. MUTMANSKY: Thank you, Cheryl. Just a comment on what Cheryl just said about the concourse. I mentioned that specifically we split the ticketing area from the concourse because we recognized that the allowances that are in the current code did not do that. And by keeping them together, we didn't have the

opportunity to really go much more aggressive on the concourse LPD value because the ticketing area was sort of holding it up, if you want to think of it that way.

We felt it was absolutely appropriate to split that out and then target that concourse separately. And that I don't like to add, you know, to the complexity of the code, but that was one place where it seemed like it was warranted to do so.

MR. SHIRAKH: Thank you.

Any other questions in the room? Any online?

MR. OWNBY: It looks like we have one question online.

MR. SHIRAKH: Okay, let's take that one question and then --

MR. OWNBY: Owen, can you hear us?

MR. SHIRAKH: You're on.

MR. HOWLETT: Oh, I'm sorry, my question was for the last session, not this session.

MR. SHIRAKH: Okay.

MR. OWNBY: Thank you.

MR. SHIRAKH: So, I think we can -- I have approximately 2:15 on my cell phone time -- 12:15, I'm sorry.

And so, why don't we be back here by 1:15. And I think we can probably still get out of here on time

for those of you have flights. You know, I'll try my best to keep on track.

(Off the record at 12:15 p.m.)

(On the record at 1:19 p.m.)

MR. SHIRAKH: Good afternoon. This is Mazi again. We're going to start the afternoon session of our lighting workshop.

We're going to start with the topic that we left off from this morning. That's Nonresidential Controls and Partial on Occupancy Sensors.

And Michael Mutmansky will present that topic. Thank you, Michael.

MR. MUTMANSKY: Thank you, Mazi. So, we'll give it a few minutes here to get -- oh, there it is. It's up and ready to go so I think we'll get started.

This case topic is Nonresidential Lighting Partial on Occupancy Sensor and Control Credits.

So, again, similar to the previous nonresidential one, we are charged with being at least equal, in terms of energy efficiency, to the best national level codes out there.

And in the most recent ACHRAE, 90.1, an approach was established as part of their Interior Lighting Controls Measure that requires you to use either manual on, what we in California call a vacancy sensor, or

partial on approach to occupancy sensor for -- they have a schedule of spaces and they sort of require them to be used depending on the space categories. And there's a big table of spaces.

In addition, we are adding into this one, also, another item that was noted, which is that ASHRAE establishes a maximum occupancy sensor delay time for spaces. And they have that in their table of controls requirements by space type. And that number varies from, I think, about 10 minutes up to 20 minutes, depending on the space type that they have defined.

The next slide; so what we're proposing is essentially to do something similar in Title 24. Require certain listed spaces to employ either partial on or manual on switching of the lighting.

Also require all installed lighting control systems, employing maximum sensor delay time of 20 minutes.

These will be changes to -- well, it says mandatory, but these are actually prescriptive requirements, prescriptive lighting requirements.

The next slide. All right so there's a couple of ways or reasons that we are able to actually do this very cost effectively.

In fact, it ends up being with essentially no

added cost.

The first is that the multi-level lighting requirements that were adopted and become code, active in July for the 2013 Title 24, requires all areas greater than 100 square feet, with an LPD higher than .5 watts per square foot, and more than a single luminaire, with two lamps, to essentially have multi-level lighting capability.

And there's a whole host of things that go along with it. But that is the basic backbone infrastructure that we needed to be able to do a partial on requirement without any added cost to the systems.

Additionally, shutoff controls are required in most spaces in a building, but there is no specific direction as to when and how to turn on the lights.

So, Section 130.1C tells you how you need to turn off lights in certain spaces. And there's listed spaces where you have to do things one way, or there's a handful of ways that you're able to comply using scheduling devices, using occupancy sensors, things like that.

But nowhere in there is there sort of a requirement for how you turn on lights. So, this is sort of the beginning of looking at those kinds of opportunities in places where there might be more energy

to be saved by not doing an automatic on kind of approach.

However, within Section 130.1C, 130.1C5 specifically requires occupancy sensors in spaces, offices 250 square feet or less, multi-purpose rooms less than 1,000 square feet, classrooms and conference rooms.

So, within that infrastructure there is essentially everything we need, the conditions are all met to be able to additionally add into that specific requirement that these spaces be done employing either a vacancy sensor or a partial on occupancy sensors.

So, that’s the most straight forward way to apply that and that’s what we ultimately did here.

Next slide. Now, so the savings calculations, there’s information out there on a whole host of different controls measures.

But partial on has not been a -- it has not been a long-term control measure that has been analyzed very much because the capabilities either require some kind of a dimming ballast, which has not been a baseline sort of infrastructure of technology, or in places it’s just not been treated that way.

Even if you had bi-level switching, it generally has been the approach that it’s automatic on for both

levels and then you can bi-level it down, but not bi-level just a single one and then it's manual up from there.

But the estimates are from 20 to 30 percent compared to traditional occupancy sensor approaches. And you can see some citations there for where some of these numbers come from.

The savings are impacted by savings from other control measures, task tuning, daylight savings, demand response, things like that.

And all of these sort of combine together to produce larger savings in combination, but individually this particular one is anticipated in that 20 to 30 percent range.

And if you had, say, a daylight -- a system going in that same space, this number might not be 20 to 30 percent anymore, but the combination of both partial on and daylight savings is going to combine to be something greater than daylight savings by itself and by a measurable amount.

The next slide; current practices is that generally the use of lighting controls is widespread. Of course, it's required by code in California.

But occupancy sensors are, I believe in many spaces, now, the de facto design approach, controls

approach for controls, with the exception of, say, large open office areas and things like that where there are so many occupants in a space that it's hard to use an occupancy sensor because of multiple-occupant kind of issues.

However, manual on sensors or vacancy sensors are not being employed in a widespread way. We do find them being used for green projects or, you know, high energy efficiency or sustainability projects.

LEAD projects, things like that often have manual on or vacancy sensor approaches for private offices and things.

And so, it's clearly a viable approach that's being employed, but it's not required in the current code in that method, in that manner.

Regular occupancy sensors are the code minimum requirement at this point.

The next slide, trends in the industry. Lighting controls are becoming a -- well, it's a huge growth aspect of the industry. It's being fueled in part by the widespread use of sort of electronics for controls capabilities at a cost that are much lower than they've ever been. And, you know, they've rapidly come down in price.

It's becoming very cost effective to be putting

small control devices in places where it just wasn't effective, cost effective to do so before.

Wireless has broadened the application of these products.

They're becoming integrated into lighting equipment, now, because lighting equipment, as it becomes more and more electronic -- electronics-based, they're adding features.

And these features might be controls capabilities, might also be sensor capabilities. They're building integrated -- fixtures with integrated sensors in them, et cetera.

RF communication between sensors and controls, and to the main, you know, computer brain of the building is becoming much more widespread in the industry.

The multi-level lighting requirements, as I stated, essentially makes this approach viable for all of the applications that we are talking about due to the inherent capability to set multi-levels within the lighting system. That was established as part of the 2013 Code.

The next slide; all right, so the proposed changes that we are working on recommending here is to add some clarifying language to Section 110.9B3 that --

oh, okay, this is -- Jon, this is your stuff, okay.

That there's some proposed changes that I haven't mentioned, yet. One of them is that there's a flicker requirement that goes in for dimming systems.

And Jon McHugh will be able to probably talk to you -- do you have a slide in here for that?

MR. MC HUGH: Yeah.

MR. MUTMANSKY: Okay, so when we get to that I'll pass it to Jon and he can talk about that in more detail.

We'll also propose adding language to Section 110.9B4, establishing a maximum sensor delay time of 20 minutes.

As I said previously, ASHRAE uses a table with different delay times for different space uses. I think it would be more consistent and easier to apply and verify compliance with if it's a single value for the entire, you know, set of conditions out there.

Inspectors will be able to test 20 minutes and not having to be looking it up on a table to figure out what kind of space this is, and whether it should be 15, or 10, or 20. So, we're going to propose a 20-minute delay time maximum.

Add language requiring either manual on or partial on controls in Section 130.1C5. And you'll see

the specific code language later on that.

We're going to remove two power adjustment factors in Table 140.6A that currently are in there to give you a PAF for partial on controls.

Since those are essentially being required, now, in most of the spaces where those are viable control methods, those will be removed as a PAF.

And then there's a proposal to add two PAFs in 140.6A for daylight dimming plus off control, and tuning of dimming systems. And we'll get some more detail on that, as well.

The next slide. All right, impacts to Section 130.1C5 is that we were requiring the employment of either a partial on or a manual on approach.

It only applies to this listed set of spaces. Office spaces less than 250 square feet, classrooms, conference rooms, and multi-purpose rooms under 1,000 square feet.

Obviously, any other space that the designer chooses to apply this is at their discretion, but these spaces are required to meet these -- meet one of these two controls approaches.

But we're going to add an exception to this, down at the bottom, that spaces that do not meet the threshold requirements for multi-level lighting in

Section 130.1B are excepted from being required to do this.

But they still must do an either occupancy sensor, or a control, or a manual on occupancy sensor control.

So, they're not required to meet the partial on part, but they would still be required to essentially have the same occupancy sensor control capability that is in the current code right now.

The next slide -- oh, that's really small. So, there we go, Jon, do you want to speak to that?

MR. MC HUGH: Yeah, why don't I.

MR. MUTMANSKY: Okay.

MR. MC HUGH: And I take it you'll take Part F and I'll take Part 3.

MR. MUTMANSKY: Yeah.

MR. MC HUGH: So, the Section 110.9B3 actually returns to the standards language that was in the standards prior to the 2013 requirement. So, this actually matches pretty closely the 2008 standards.

And what it does is it clarifies that the issue associated with flicker, which was moved to Title 20, which is the California Appliance Efficiency Standards, those requirements were applied to controls.

And the reality is that flicker is not a

function just of the control, but also of the thing it's controlling.

And so this clarifies, even though the language earlier said that all the requirements associated with controls applies to the entire system, this clarifies that flicker specifically applies to these systems.

And similar to what we were talking about in the residential portion of the presentation, that there is a test method in -- proposed for Title 20 that basically relaxes the requirements as compared to the Energy Star.

We're actually filtering out the higher frequencies and looking at flicker only for frequencies below 200 Hz. So, that's that portion of the requirement.

And then Item F, I'll let Mike describe.

MR. MUTMANSKY: So, Item F is the part where we essentially are adding a requirement under Subsection 4, of occupancy sensing controls. Those are the definitions there, A through E, of the various occupancy sensing controls that could be employed in a building.

And they all essentially refer to Title 20 for the appliance efficiency regulations.

And in Title 20 it refers to the fact that none of these controls are permitted to have the infrastructure built into the device to accommodate

longer than a 30-minute delay time to turn off the lights.

And F is added in to essentially say that these devices that are not allowed to be built to have a longer than 30-minute delay time, shall not actually be programmed in the field to have more than a 20-minute delay time.

So, when these things are being inspected in the field they can -- they can just be verified that they have the 20-minute delay time and go from there.

Obviously, after the fact a property owner can go in and choose to lengthen their delay times, if need be, but most of them won't feel the need to. Twenty minutes is adequately long enough for every application that I've run into.

But, occasionally, you might want something a little longer and that's still available to those people who want that.

The next slide.

MR. MC HUGH: So, I'll take this section. So, this is Section 3. This is basically a cleanup measure to -- in the last round of standards we had a requirement that would allow you to pick one of five. Which, you know, that works well for something like LEAD. It's a little bit problematic for standards where

the building inspector would prefer to have something a little less complex and a little more straight forward.

In addition, Item A there says, of the five methods it was manual dimming that met the requirements of 130.A.

So, if you look at the controllable lighting requirements, pretty much, you know, a fairly significant fraction already was required to be dimmable.

And so what this does is it replaces those sort of pick-one-out-five with just you shall have a dimmer, a manual dimmer and that meets 130.1A2C

So, the next slide, please.

MR. MUTMANSKY: All right, so here's the new language that's proposed for 130.1C5, which is that very specific, narrow area that defined the space types, 250-square foot offices, multi-purpose rooms 1,000 square feet -- less than 1,000 square feet, classrooms of any size and conference rooms.

What we're adding here is that the, at the bottom -- it's sort of in the middle there. The occupancy sensing controls shall function either as a partial on occupancy sensors or B, a vacancy sensor.

And then we're adding the exception down below for any area that doesn't meet the requirements of

130.1B, which is that the multi-level lighting requirements must use either occupancy sensor or vacancy sensor control methods because, ultimately, at that point, the partial on approach is not available for the system to use.

The next slide; additionally, we noticed a little bit of cleanup would be required in Section 6, at 130.1C6 and 130.1C7, just to avoid confusion.

Those two areas refer to areas where partial on/off occupant-sensing controls are required or areas of partial on/off occupant-sensing controls are required instead of and in addition to complying with.

What it turns out is those two sections are really talking about partial off controls, not partial on. So, we wanted to eliminate that so that there wasn't confusion about partial on down there, with this Section 5 up above that we just discussed.

The next slide -- what is this?

MR. MC HUGH: Oh, this language here is in -- it should say 140.6A2, not 160. But in any case, this is the language that described the definitions of the partial on occupant sensor that was getting the PAF.

And since part of Mike's proposal is to remove the PAF, we no longer need this in Section 140.6.

In addition, the area that talks about the

exception, that exception applies to that one out of five things that you could do. The one out of five measures in Section 130.1B that you could also get a PAF.

So, this is basically helping simplify and make more clear the code, so this is part of the overall code simplification.

MR. MUTMANSKY: The next slide.

MR. MC HUGH: So, this one is a cleanup to the requirements associated with accessibility to the calibration elements for a daylighting control.

And this language was written originally, its primary purpose was that there was a history of some of these calibration adjustments being located where the photo sensor was, which happened to be in a skylight light well 20 feet off the floor.

And so, you know, potentially you'd have to get in a lift if you needed to adjust your adjustments.

And so, the intent of this is to make sure and to make clear two things. One is that the photo sensors, themselves, are not readily accessible to unauthorized folks, so that they don't put their sticky note on top of it, or do the various fun things that people do to sensors.

And the second one is that someone can

essentially walk up to make the adjustments to photo controls. And yet, the language for readily accessible which, you know, for many of you that are involved in electrical wiring, you know is in the National Electrical Code.

And that language, you know, originally was primarily focused on over-current protection devices that you can walk up and immediately open the door and, you know, shut off a breaker or whatever.

Well, what we're saying here is it's readily accessible, but it's allowed to put a locked door on it, or have a special tool so that people that you don't want fiddling with adjustments can't.

The next slide. Okay, so this next one is the reduction of -- so, these are the two power adjustment, new power adjustment factors.

And this first one is based off of what's actually in ASHRAE 90.1 2013, which requires that all daylighting controls actually dim or step-dim your lights down to zero.

So, when you have full daylight in the space, you turn the lights all the way off.

So, this one here would give a power adjustment factor for continuous dimming systems that also turn their lights off when full daylight is available.

This is similar to, you know, probably one of the largest landowners that has a -- or property owner that has daylight space is Wal-Mart. I think they've got something like 300 million square feet of day-lit retail spaces.

And their standard design is daylight dimming to off. So, they dim all the way down and then they turn the lights off and save approximately 20 percent of full power when there's full daylight available.

Because when you dim a light all the way down, it's around what your consumption is.

The second one is a power adjustment factor for manual dimming controls with high end trim and tuning.

So, what this does is this would give a credit for a system which has high end trim and the designer has listed on the plans the design illuminance, and someone has then adjusted the lights to the design illuminance in the space.

And then that effort is verified through an acceptance test that's described in some language we'll talk about later.

The next slide, please. And so this is the table. I know it's kind of small for people in the audience. But the main thing is that we're looking at a 10 percent power adjustment factor for daylight dimming

plus off, and a 5 percent power adjustment factor for manual dimming with high end trim and tuning.

MR. MUTMANSKY: In addition --

MR. MC HUGH: Oh, yeah, go ahead.

MR. MUTMANSKY: -- we're also removing this partial on PAFs that were in there. Number one, at the top, was a partial on that's being removed.

And the very bottom, number five, was a partial on for where there was also a manual dimming in there and so, those two are being removed.

And in the middle there is a third one, a dimming systems PAF that appears ultimately to be sort of an unnecessary PAF now that the multi-level lighting requirements are in place.

So, those three items are being removed and we're adding two new ones to the list.

So, the next slide.

MR. MC HUGH: This is a description of the language for the acceptance test for tuning. And all the acceptance tests have two components, one which is first a construction inspection and then a functional performance test.

And for the construction inspection the first thing is to actually make sure that there are the design illuminances on the plans because you can't conduct the

test without the design illuminances.

And before you continue on with the test you have to go back to the designer or the building owner to obtain those design illuminances.

The second part is to -- we don't give credit for lights that are in the day-lit zone because their high end is actually being adjusted by something else, which is the daylighting control. So, this is focused on those areas that are not in the day-lit zones.

Then the third thing is to actually verify that there is some method. You know, nobody's going to go through the acceptance test if there was actually no way to adjust the output of either the ballast or the high end trim on the control, itself.

And then, finally, to make sure that the wattage that is claimed for receiving the power adjustment factor matches the claimed wattage on the compliance documents.

The next slide, then the actual functional performance test, itself. This allows for a statistical survey of identifying whether or not the spaces have been tuned, similar to what we do for occupancy sensors and other controls that you might have, you know, many of them. And so, we want to sort of keep control on the costs of the test.

So, if you have a fairly small building and you only have seven zones, then you have to test all seven zones.

And then if you have buildings with more than seven zones, then if those all work then you're good, you've sampled them.

And if any of the systems in that group of seven fail, then you have to test another group of seven zones. So, that's sort of the sampling part.

And the test is actually quite simple. You identify the design foot candles from the plans, you measure the average illuminance due to the controlled electric lighting at its maximum output, and then you document that the measured average illuminance in that area due to electric lighting does not exceed the design illuminance by more than 10 percent. And so, it's fairly straight forward.

The next slide, please. So, I think we've already talked about the flicker requirements, but the primary thing to note is, having done research on daylighting systems, this is the third most common reason for failure of dimming systems which, after having the control system controlling too large a space, or that the controls were not adequately commissioned.

The third one is, oh, I'm dimming the lights and

they're starting to flicker. Well, I know how to fix that, I just disable the control.

And as we know, flicker's a reason for people who dislike high-efficacy lighting.

The next slide; we saw this picture before so we can move on from this one. This describes the Lighting Research Center study on flicker.

There is an IEEE group that's working on both the measurement and a flicker metric. And the thing to notice here is that they have, you know, areas -- amplitude modulations below which there is no effect. That's shown as green on the slide.

And the area in yellow is the area that they call, well, there's some effect but it's relatively low risk.

And the thing to note here is if you look at that star, that's describing the point at which there's 30 percent modulation at less than 200 Hz. And so you can kind of look at that, at that star as kind of a bottom of a square, or a rectangle. That's to the upper left-hand side of that star, which is the areas which products would not pass the California flicker requirement.

And what this should point out is that we're looking at a fairly conservative standard in terms of

actually letting a lot of stuff through. So, it's something relatively easy to meet.

The next slide; this just describes the rationale, which I believe we've talked about before. But just noting that we have appliance efficiency requirements for no more than 30 minutes for the control, and this allows the installer to program the 20 minutes.

And also has language here that notes the corresponding language in ASHRAE 90.1. So, we're harmonizing with the National Building Efficiency Standard.

The next slide; do you want to say anything about this?

I think you've described this earlier, this is the --

MR. MUTMANSKY: Yeah, I think we've hit on this. Go ahead and hit the next slide, yeah.

MR. MC HUGH: Okay, this one here is just showing that there is 10 percent plus savings. And, you know, done a similar type of calculation with SkyCalc, which is a tool for measuring the energy savings from skylights, and put in a custom control feature to model that. And found that, indeed, the savings were over 10 percent using that tool.

And then below that is the language from ASHRAE 90.1, which identifies that ASHRAE 90.1 2013 specifically talks about a third control point that turns all the controlled lighting off. So, it indicates that we have basically the very minimum compliance with ASHRAE 90.1 is two levels of control plus off.

And we're going further because in most cases we're requiring dimming, but the effect is fairly similar.

The next slide, please. This is from the Pacific Northwest Labs. They did some research in support of ASHRAE 90.1 and looked at the -- in this particular slides, this shows the impact of various lighting control strategies. And these are looking at the ASHRAE climate zones.

And for California, we're primarily interested in the ASHRAE climate zones 2-B, which corresponds to, essentially, our climate zone 15, which is El Centro and that part of California.

And the vast majority of California would be covered by 3-C, which is shown there for San Francisco.

And the thing to note on these slides, so I'm looking at the two graphs that are in the bottom right-hand corner there, labeled Phoenix and San Francisco.

What you see there is four lines. The top two

lines for both of those are the amount of energy change associated with daylighting controls. And on the X axis is visible light transmittance. And it varies from, I believe it's zero percent to 80 percent.

And when you look at this, the top two lines are a continuous dimming control, but it doesn't turn off, and a two-step dimming control.

So, the control goes 100 percent, 70 percent, 30 percent, but it doesn't turn off. And so those are the top two lines, which shows that there's, you know, somewhere about for San Francisco there's about one and a half percent savings.

And the bottom two lines, which are rather close together, are the step control and the dimming control plus off.

And you can see that for San Francisco there's an additional one percent savings.

So, there's something on the order of, you know, a 40 percent additional savings from adding the off portion to the control.

So, you know, a very good impact in terms of increased energy efficiency.

MR. MUTMANSKY: I think it's important to remember that what Jon's talking about with these are daylight zones where you have a preponderance of time

where your lighting system is down at its minimum setting, which would be, you know, a 10 percent setting on a 10 percent ballast, which is using maybe 20 to 25 percent of your full input power to produce 10 percent light.

So, you're really running at a very inefficient fluorescent system at that point, if you're using fluorescent.

And it's not going to be impacting zones where you're actually not running at minimum settings very much. So, it's really, primarily, your primary day-lit zones and maybe some of your top light zones.

MR. MC HUGH: Yeah, so this particular language is specifically -- the power adjustment factor is for the primary side-lit zone and for the sky-lit day-lit zone, but not the secondary sky-lit zone because there is so few hours where you're fully saturated.

The next slide; this next one describes that when we brought the controlled lighting measure into the standards it was estimated that tuning would save as much as 15 percent of the energy consumed by the lighting system. And that this requirement would give back to the designer, you know, a portion of that if they actually put the design foot candles on the plans and did the high end trim tuning.

The next slide. Do you want to go through the inputs from stakeholders or would it be better just to go straight to the comments, Michael?

MR. MUTMANSKY: You mean from the previous one?

MR. MC HUGH: The remaining sections are the sections that has the --

MR. MUTMANSKY: The previous comments?

MR. MC HUGH: Yeah, previous comments.

MR. MUTMANSKY: No, let’s just go to feedback. I think that’s probably the best thing to do.

So, Mazi?

MR. MC HUGH: So, we’re just going to skip this and we’re just going to take comments now.

MR. MUTMANSKY: We’re going to skip to the comments, now.

MR. SHIRAKH: Okay, any comments in the room on this?

Please.

MR. HARING: My names Richard Haring from --

MR. SHIRAKH: Is your microphone on, sir? The green light.

MR. HARING: Hi, thanks. This is Rick Haring from Philips Lighting. I’d like to thank the Commission for this opportunity to participate in this rulemaking.

We’ve noted the current proposal adds provisions

to Section 130.1C, whereby a partial on occupancy sensor would have the automatic on level set to between 50 and 70 percent of full power.

Philips disagrees with the proposal to set a minimum automatic level to 50 percent. This limits the amount of energy savings possible with today's control technologies.

We propose only to set a maximum limit for the partial on function or, if a minimum is deemed necessary, then we propose to change this minimum limit to 10 percent.

We recommend that the language read, "Partial on occupant sensor would have the automatic on level set to no more than 70 percent of full rated power or partial on occupant sensor would have the automatic on level set to between 10 and 70 percent".

On a similar note, we would also like to add provisions for intelligent luminaire functionality in open office spaces.

Our proposal is to add an exception in 130.1A, area control for open office applications when partial on luminaires are used with controls embedded in each luminaire.

Our rationale is that these systems provided embedded occupancy and daylight control in each

luminaire. And upon occupancy, the lights turn on with a background level which is 10 percent power. Then once occupancy is stable, lights increase to a higher task level to provide task illuminance at the dusk.

The task level for open offices is preset at approximately 90 percent of full power.

These granularly-controlled systems save more energy than an auto-on to 50 percent system because they turn lighting on to 10 percent power and operate in an individual luminaire level, rather than a group control.

In these cases, a manual on switch is not needed, nor is a manual off switch because lights turn off when the area is vacant below the luminaire and automatically turn on to background levels upon occupancy.

Our recommendation is to add the second exception to read that “in open offices luminaires using embedded occupancy and daylight sensors in each luminaire, together with continuous dimming drivers ballasts that operate in a manner where each luminaire has integral occupancy sensors that automatically turn on between 10 percent and 30 percent power upon initial occupancy turn to a higher level when fully occupied, and automatically turn off when unoccupied”.

And a second option is “integral daylight

sensors that automatically calibrate at each activation need not be controlled using manual on and off lighting controls".

Thank you.

MR. MUTMANSKY: So, I've got a couple comments on that. The 50 percent number was placed in there to align it with the table in the multi-level lighting -- the multi-level lighting requirements table, which I believe is 130.1B, or is it A? Do you remember, Jim?

Okay, so basically in there it states that there's certain requirements for certain light source technologies. And within those light source technologies you -- for example, if you have a linear fluorescent system, you're not required to do continuous dimming. You're required to do at least a four-level plus off, multi-level ballast or, you know, a step ballast. And one of those ranges is 50 to 70.

Now, I understand where you're going with the from 10 to 70 value. But one of the other things that we are trying to do is ensure that there will be a high level of acceptance of a lighting control system, you know, if you want to say "out of the box".

We don't want somebody to go in and program, say, a system to come on automatically to 25 percent, which then they go over immediately to the wall and hit

the button, and override to 100 percent.

What we want them to do is to come in, it hits 50, they feel pretty good about that and they don't override it to 100 percent, they leave it at 50.

If that occurs there's a gain, there's a savings there.

If you have information to support going lower that won't incur higher override rates, I'd love to get some information.

Because this is, frankly, one of those places where there's not a huge amount of research that I have seen on occupant overrides occurring in spaces. There's a little bit, but not huge amounts of research.

And the other mention, the other thing that I wanted to mention was you said something about switches not being required once you're -- once you have a system that's sort of intelligently adapting to a space.

We still ultimately, in the code, have a requirement for a switch on the wall that has access to all the levels of lighting that's in the ballast or in the driver, and has override off capability.

And at this point there's no discussion from any sort of angles that we would be eliminating that requirement.

So, regardless of whether or not it's capable of

functioning on its own, we still have to have a switch at the wall that gives you access to all of the levels in there.

So, it doesn't necessarily -- it's just a counter point to what you're saying that a switch is still required even though, as you're saying, a switch is not needed because it is in sort of autopilot mode.

MR. BENYA: Jim Benya here. I'm actually kind of intrigued by Rick's proposal.

When we think about the standard we're working with today, the case reports for that standard were done in 2010. They were done long before the idea of intelligent lighting, as it's evolving today, was even thought much about.

So, I think there's some validity here in looking at opening things up. Not necessarily closing them down, but giving designers more options. I think that was said earlier today, too, a couple times.

So, I think it's something worth taking a look at. I think that it was a really good comment and I think -- needless to say, I think your historical history is right on.

The real question is are we opening our eyes enough to the future because keep in mind when this standard goes into effect it will be 2019, or 2018,

anyway.

MR. MUTMANSKY: 2017.

MR. BENYA: 2017, I'm sorry. I'm getting ahead of myself. It will be -- and I hope I'm not --

MR. MUTMANSKY: In the future.

MR. BENYA: It will be 2017, sorry. But still, that's a ways in our future and I don't want to paint us in a corner where designers are too limited.

So, we'll put this on the agenda for further discussion.

MR. SHIRAKH: Jon?

MR. MC HUGH: Yeah, so I guess I have a comment and then I've got some questions because, like Jim, I also find this intriguing.

I guess the first comment I'd like to say is hopefully you're aware about the fairly significant power adjustment factors that would be available to a product that on a luminaire-by-luminaire basis is controlling lights on and off, or on and dimmed. I'll have to look again about it.

But if you look at the power adjustment table, as the areas controlled get smaller, the power adjustment factor gets larger. So, you might want to take a look at that and maybe there's some recommendations around that table in terms of what

qualifies.

And then the thing I'm trying to understand was you were talking about coming up to 10 percent and then at full occupancy it gets brighter. So, I'm trying to understand what you mean by that?

Is that it first senses, and then when you sit in the chair under those lights that it's looking for a time basis for now setting the lights up brighter? What did you intend? I'm just trying to understand.

MR. HARING: Either a time or additional occupancy.

MR. MC HUGH: So, more people in the same room then the room levels come up higher.

MR. HARING: Right, yes.

MR. MC HUGH: Okay.

MR. BENYA: But the other thing I just wanted to say in response to that, keep in mind what power adjustment factors have been for, why they were developed, and how they've ended up being used.

I'm not a big fan of power adjustment factors because what they encourage you to do is use more lighting power.

And their original purpose was to encourage people to use better controls.

We're now reaching the point where better

controls are with us. And so, the power adjustment factors, in my opinion, need to start looking at -- we need to start looking at them as maybe a legacy idea whose time may have come and gone.

So, one of the things I'm going to propose we do is take a really hard look at what was discussed earlier about power adjustment factors, and maybe even develop some better tables.

That was one of the questions I wrote down is might addressing the complex of lighting options be better handled with a table, now?

And perhaps, even eliminate or minimize the use of power adjustment factors instead.

So, that's why this is intriguing to me because the table would allow more options.

See, the real problem we face, in my opinion, is we're going to lighting control systems when we used to rely upon lighting control device.

And once we include intelligence, we can do many more things we couldn't do before.

So, this is an exciting time of change. Let's just put it on the list, this is a really good one to think on some more.

MR. MUTMANSKY: Well, I agree with you, Jim, that the PAF tables seem like something that had an

effective sort of vehicle in the past, but as controls are becoming so prevalent and so sophisticated, now, it seems like their usefulness may be coming to an end.

And my thinking was that we could eliminate most of the PAF line items in their without, you know, essentially adding more as time went on.

At this point, we're keeping it at about the same size, but maybe we can drop some of those out.

MR. MC HUGH: I guess since we're talking about this, I'll put in my two cents.

What's interesting is that California's had the power adjustment factors I think since 1992. And this was something that allowed the State to do two things.

One is that it gave credit for new products. And if you look at the rise of the occupant sensor, way back when in the early 90s, the power adjustment factor was the thing that really helped jump start the occupant sensor industry.

Admittedly, that industry is very robust and we actually -- you know, once it actually gets to a certain critical mass it ends up as a mandatory requirement in our Section 130.1 standards.

My expectation is that there will still be innovative controls that we won't want to mandate, that will be desirable for people to use.

The other thing is that there was a huge push by ASHRAE 90.1 because their hands were tied. They didn't have a power adjustment factor table. And so, it really created a need to give credit for controls.

And so, then there was, you know, the discussions about a kilowatt hour basis, rather than an LPD.

And the fact of the matter is it's a lot easier for -- you know, I'm always looking at compliance and enforcement. It's a lot easier for the code official to identify what's installed, rather than, you know, potentially a fairly detailed estimation of the interaction between LPD and control.

So, I might be considered a Luddite, but I actually think that the PAF still has some use.

MR. SHIRAKH: Well, I agree with Jon that we've used the PAF to first encourage occupant sensors, just a regular occupant sensor.

And then, when it became more commonplace we moved that into the prescriptive standards. You know, we used the PAFs to encourage multi-level occupant sensors. And other technologies, daylighting controls, and so forth, so it has actually served that purpose.

So, for that reason I'm inclined to keep it. Maybe we don't need everything that's on it to be there

anymore, but it is definitely a vehicle to move things that are kind of like on the cutting edge into the prescriptive standards, you know, given the incentives and so forth.

MR. HARING: Thank you. We can provide some more information in our written comments.

MR. SHIRAKH: Okay, thank you.

Sir.

MR. JOUANEH: Michael Jouaneh, Lutron. Just a clarification question, really, on the -- can we see the slide on tuning acceptance testing because I'm not sure if I understood it right or if it was worded properly.

MR. MC GARAGHAN: Do you remember which, how far back?

MR. MC HUGH: It's near the end so just keep going back.

MR. JOUANEH: No, it was near the beginning.

MR. MC HUGH: There you go, you already passed it. Keep going. Keep going. There you go.

So, there's two parts to the acceptance test, the first one which is the construction inspection. And is this the slide that you're looking for, Michael?

MR. JOUANEH: I think so. Can we move the participants? No, that's not the slide.

So, there was a slide that basically said --

MR. MC HUGH: There's the next slide. Can you go to the next slide which is the --

MR. JOUANEH: Okay, letter C there. So, "document that the measured average illuminance due to controlled electric lighting does not exceed the design illuminance by more than 10 percent".

Wouldn't we want that to say, "document that the measured illuminance is at least 10 percent lower than the design illuminance"?

MR. MC HUGH: No, because we -- if someone wants to actually tune it and they perfectly tune it to the design illuminance, that's success.

The issue is -- for tuning is that in some cases people might have designed, you know, out of the box, and that the system might be providing 150 percent of the design illuminance. We're actually just trying to make sure that they get within 10 percent of the design illuminance.

So, if someone designed a 30-foot candles, and they hit 30-foot candles, you know, or even 31-foot candles, they're good.

MR. JOUANEH: Okay, so they don't have to --

MR. MC HUGH: We're not trying to actually limit the design. We're saying that your system is providing the design illuminance within some, you know, measure of

error.

We're not trying to say we're actually removing what is considered the appropriate illuminance levels. We're not saying you shall have 90 percent of what's considered appropriate. That's not the proposal.

MR. JOUANEH: Okay, so -- okay, so if you meet the design illuminance then you get credit for tuning?

MR. MC HUGH: Yeah, exactly.

MR. MUTMANSKY: So, what this is doing infrastructurally --

MR. JOUANEH: That's not how I typically think of tuning but --

MR. MC HUGH: Yeah.

MR. MUTMANSKY: Right, exactly. What this is doing is this is adding a layer to the design process that a lot of designers aren't doing, but some designers do. And that is they're putting a table on their CDs with target illuminance on it.

And then, in the field somebody goes out and tests, and sets their trim to their target -- you know, their target and they're done.

This is giving them, essentially, a PAF to actually go through that process.

So, if you happen to design a lighting control system that meets that, without having to trim it at

all, that's great, because some spaces are going to be that way. But a lot of them are not, they're going to be maybe 10 percent, 20 percent over because of the number of luminaires that have to fit in the space, or the spacing, you know, of the space. There, then you trim it back to whatever the number is, you're within 10 percent of your target and you're good to go.

MR. JOUANEH: So, it can be within 10 -- oh, it has to be within 10 percent. It can't be even a lot lower, or it can be --

MR. MC HUGH: Well, it says --

MR. JOUANEH: Not more than 10 percent. But you could be a lot lower and still --

MR. MC HUGH: You could be a lot lower, right. And the issue is what happens if your full output's 80 percent of your design illuminance? We're not going to say now you've got to replace all your light fixtures.

That might be desirable, but we're not doing that as part of an energy standard.

MR. BENYA: This is going to require a little bit of work. I can see a lot of pitfalls in this from a design stand point, from a measurement stand point, from a field acceptance testing stand point.

I think this is going to require us putting our heads together a little bit more.

I think the concept in general is if we look back at the controllable lighting CASE report that got all this started tuning was used as the primary evidence that it was cost effective.

What this proposal does is it puts tuning in, that you're actually using tuning as a PAF.

One of the things I'm not completely comfortable with, yet, is that instead of your choice of five -- so, the whole controllable lighting thing was that once you had controllable lighting you knew you were going to have to -- in addition to having multi-level lighting in the space, you were going to have to pick a strategy.

And if the building was big enough, you were going to have to do demand response, okay.

All of those things have to happen. So, what we've got to do is a little bit of logic to make sure that we're not double-dipping on PAFs for things that are already required by code.

I didn't see the logic of that come out of this work, so I think we're going to want to go over it once. But let's put it on the -- you know, this is very interesting and I think it's very important, but let's put it on the list of things to make sure we got it right.

MR. MC HUGH: And Jim, I look forward to your

experience in terms of looking at, you know, the mechanics of tuning.

But if you look at what this is, this is a power adjustment factor. It's not a mandatory measure. Currently, the standard does not require tuning.

As proposed, the standard does not require tuning. This would actually jump start the process of actually giving people credit for tuning.

And, ideally, you know, if you're paying for the controllable lighting, you might as well get that 10 to 15 percent savings.

And so, ideally, this sets us towards the stage where every system is ultimately tuned.

But in the short term, you know, the market's probably not ready for that. And so this, again this is actually pointing out one of those benefits of the power adjustment factor. It's not required.

And, you know, the other issue is that power adjustment factors are not only used for putting more lighting power in the building. The other purpose of having power adjustment factors is they actually give credit for -- you know, for instance all State buildings have to be LEAD, silver. So, you know, they need to exceed the energy code.

And this actually gives people credit for "doing

the right thing" and actually tuning their lighting systems.

So, there's a number of things in terms of utility incentives, the LEAD Program, all those sorts of things that, you know, having a power adjustment factor helps push forward.

MR. SHIRAKH: Gary?

MR. FLAMM: Hello, my name is Gary Flamm. I want to disclose that I am a previous employee of the Energy Commission and I am here as a private citizen. I am not making any money for being here.

So, first I want to talk about the technology of multi-level occupant sensors.

The new multi-level lighting controls requirements go into effect in a couple weeks and we don't have any experience with how that's going to be complied with.

It is my understanding for multi-level occupancy sensors up to this point, they're typically a vacancy sensor on one leg and an occupant sensor on the other leg or there's a hypothetical device, which I don't know if it exists, yet, which is in Title 20 called a multi- -- or a partial on occupancy sensor, which is basically two switch legs.

But now, for all practical purposes, although we

all recognize that in the Table 130.1A, for linear fluorescent there's an allowance for four separate lamps in a luminaire to be separately circuited, switch legs.

But for all practical purposes I believe that most of Table 130.1A is going to be complied with via dimmable.

And my question is, is there a dimmable occupant sensor available? Does that device exist because I'm not aware of it?

What I'm aware of is multi-level, multi-switch leg occupant sensors.

MR. BENYA: There are standard dimmer and motion sensors from a number of manufacturers.

MR. MUTMANSKY: Not only that the way -- when I talk with manufacturers about how they are essentially planning on solving the current code which, you know, comes in in a couple of weeks, they're using traditional occupancy sensors and running them to a brain, essentially, that then defines what the lighting system does based on the inputs.

MR. FLAMM: Okay, so those devices -- I guess my question is, because I wasn't aware of where the technology was. What I'm traditionally familiar with are the two-switch leg type of controls.

Has the cost analysis considered that we're

talking about a new type of control system?

MR. MUTMANSKY: Yes, the -- however, the baseline for the partial on requirement is the new code, not the 2008 code where it didn't have that control system.

MR. FLAMM: So my concern, the reason I brought this up is I was concerned that this was a theoretical device and not a device that really exists in the market, yet.

MR. MUTMANSKY: Right, now, so my understanding and through conversations with the manufacturers' reps is that they have a good bead on how they're solving the 2013 requirements.

And when we discussed this added layer, this partial on part, they looked at it and said, well, you know, this is simply a case of a programming issue in how we install the same system that's going in for 2013.

MR. FLAMM: Okay.

MR. MUTMANSKY: So, it ended up being a non-cost. You know, there's no cost in accessing it.

MR. FLAMM: Okay, and I didn't know -- I honestly didn't know the answer to that. I just know what I was familiar with.

So, that goes to my second level question is that we've got to -- we've evolved to a very complex

control requirement for nonresidential.

There's two manual switches, a manual on and off which allows the occupant to go into a room with no lighting, if that's their choice, or to go into a room with less than full lighting, if that's their choice. That's the purpose of the manual on.

Then we've got manual multi-level. Then we've got three automatic controls. We've got automatic shutoff, which is going to be time-based or occupancy-based.

We've got automatic daylighting and that's where you segregate the daylight zones.

And then you've got demand response requirements.

So, my question is, my concern is that no control is an island anymore. And I would -- I believe that it's responsible for the Energy Commission any time new controls are added, to demonstrate through a variety of prototypical buildings that you can wire that building to meet all five of those controls.

So, as the Energy Commission considers more control levels can you do that in an office? Can you do that in a warehouse? Can you do that in a retail store? Can you do that in every prototypical scenario?

So, that's my question is even though we've

traditionally looked at controls as one piece of a pie, I believe that the controls are now at a critical point where they're interactive.

MR. MUTMANSKY: I completely agree with you. And, in fact, you know, as you just said, I mean what has ultimately occurred is the most recent revisions that are going in, in a couple of weeks, where the opening of Pandora's Box to highly integrated controls in California.

Now, because it hasn't actually started being constructed that way, yet, we haven't seen the physical results of it too much.

But the solutions that everybody are proposing for the requirements that are actually baseline code right now are at that high enough level that the integration is very high already.

I mean, essentially, everybody is using, are planning on solving most of these problems with control systems that have some kind of brain in them.

And most of those are capable of either operating on their own, in a room-by-room kind of basis or, you know, a lot of them are capable of being plugged into the main computer back in the server rack room.

So, you're absolutely right. I mean what we're going to is a place where these things are all wired up

somehow and at some point they're all just sort of computer inputs on these digital devices.

And I actually think what we're talking about actually occurred in the last cycle. It's just that because it hasn't actually been realized physically yet because of the timing on the code, we haven't seen that that's actually what occurred.

MR. FLAMM: And I'm curious if the designers in the industry are ready for the 2013 standards to make these five levels of controls work?

MR. MUTMANSKY: My understanding or impression is that the designers -- obviously, they have a lot of questions that need answers.

But the manufacturers' reps are all over this. I mean they went in, they dissected it, they analyzed the situation and various manufacturers, some of which are represented in the room, and their representatives have come out with, you know, here's your game plan for how to meet these various requirements.

And they've been doing a lot of presentations over the last eight months or so in preparation for when it was going to actually be enacted at the end of the year.

So, they've actually had a long time to actually prepare for this and sort of get the word out to the

design community.

My bigger concern isn't the design community, it's the contractors out there and, you know, how competent are they going to be to get all these things commissioned?

And I believe everybody's working very hard on that, as well. So, you know, I think we're moving in that direction.

MR. FLAMM: Thank you. Another point I wanted to bring up is that there's some language in Title 20 that I'm assuming you're aware that the whole partial on/off, all that language Title 20 and Title 24 staff worked together to make sure that there were no conflicts between the two codes.

And I just would recommend, if you're thinking about changing partial on language, to make sure you coordinate that with the Title 20 staff to make sure there's no conflict between the two codes.

Target illuminance for acceptance testing is influenced by daylighting.

I think one of the big unknowns with the new acceptance tests are some projects are going to be small and straight forward, some are going to be huge and complex.

Some of these acceptance tests appear that

you're going to have to cardboard off daylighting or you're going to have to come back at night.

And so, I'm not confident that in every case it's going to be cost effective.

So, when you're talking about a target illuminance and, by the way, we have -- between the different documents we talk about design foot candles, and installed foot candles, and initial foot candles, and we do not have a consistent dialogue.

Whereas you commented a little while ago, and it was stated earlier today, most people when they design, they reverse engineer their LPD and that's the -- they're foot candle is serendipitous. It's not really a design foot candle.

They end up with an initial foot candle, which is before lumen appreciation, et cetera.

So, I just would like to see that consistency that the right language is used and that consistent language is used.

MR. BENYA: Gary thanks because these are some of the things I didn't really want to get too much into right now. You know, there's no standardized definition as to where the readings are taken, how the readings are taken, meter calibration, you know, the list goes on and on.

And light levels are very complicated stuff to put in a standard and expect universally well-applied. So, your cautions are very much appreciated and, yeah, I was thinking the same thing.

MR. FLAMM: Okay. And one last comment is historically the reason that we have this intermediate step, somewhere between 50 and 70, is in earlier versions of the standard some folks were successfully arguing that 100 percent and zero percent is multi-level lighting.

Therefore, if I have an on and off switch, I have multi-level.

So, we started with all of these machinations about, well, if you have checkerboard, or if you have in-board/out-board, or if you have alternate layers, alternate rows.

And so, the whole issue was that you've got 100 percent, zero percent and you've got something in between. And so that's why those numbers, those middle numbers exist, just a little historical context.

Thank you.

MR. SHIRAKH: Thank you, Gary.

Any other comments in the room?

Any comments online?

MR. OWNBY: Yeah, we have one comment from Owen

Howlett.

MR. SHIRAKH: Hi, Owen.

MR. HOWLETT: Hi, this is Owen Howlett.

MR. SHIRAKH: Yeah, you're on.

MR. HOWLETT: Hi. So, I had one comment just to follow up on the discussion about power adjustment practice. You know, there are two ways in which was a power adjustment could be effective and one of them if it helps somebody to get to a target LPD.

So, of course, that requires that the target LPD is actually challenging to get to.

And, of course, in the 2013 codes office LPDs were reduced to a level that was more challenging and retail was reduced to a level that was more challenging.

I imagine those LPDs will still be somewhat challenging for the 2016 code, so I'd expect that they actually would remain as a useful way of actually complying with the code.

The other use -- the other use of a PAF that we ought to not forget is that they're useful in utility programs.

So, if somebody's trying to get -- is in Savings By Design and they're trying to get certain out below code, or if they're going for a LEAD certification and trying to get certain output below code that PAF is

useful for them to do that.

So that's another, you know, important role they serve for emerging technologies, leading emerging technologies.

Also wanted to note about I do -- I share Jim's concerns about the tuning and the fact that in the last code cycle the CASE report on durability or control, multi-level controls was predicated on the fact that if the dimming was installed, then there would be a certain amount of savings that came from that in the form of tuning or manual dimming.

If we are going to start giving people credit in the 2016 code for doing something that we assume they would do of their own accord for free, then I think that's potentially setting a bad precedent for the internally counting of the code. And I hope that the CASE teams are paying attention to all of that accounting.

The main, I guess, point I wanted to make, slash question is, Michael, you were talking about the partial on controls and the partial off controls, and all that stuff. The way you were explaining it made me think about it from a different direction, which is -- and let me know if this useful and whether I'm kind of paraphrasing it correctly.

That one of the things that would be helpful to do is to get rid of the -- or to no longer give people the option of a fully automatic, fully on control.

So, all those spaces in which somebody can walk into that space and all the lights are turned fully on automatically, without that person having to press a button or do anything else, that's the option that it will be useful to get rid of to save energy.

And that made me think that giving people a menu, kind of like the one to five menu that was originally in -- well, is in the 2013 code, that you could give people the option of having either the manual on control, a partial manual on control, or partial off control, but you wouldn't give them the menu option of having a full auto on control.

So, you'd give people that kind of three-option menu and that would preserve some flexibility for designers to choose the system they think is most appropriate for that space, but it would still ensure that they choose one of those three energy-saving options over the fully automatic on.

So, that's my question if -- whether I'm capturing your intent correctly there and whether you think that's useful?

MR. MUTMANSKY: Well, I think that you're right

in that we don't really want to have lights turning on by themselves. We want the humans in the space to, you know, actually interact, and just enough to assert that they need more light.

So, light comes on at a level, whatever the level is, 50 percent. That might be about half of what the design target illuminance is for that space.

And for a lot of people that may be actually just fine and they're good with it.

If we know that a -- if you require them to actually get up and change the status of their lighting system, a certain percentage of them won't do it because it's actually good enough and they're not bothered by it to actually do something to change it.

You know, and plus we have this sort of push towards task lights, as well, which is lowering the general lighting requirements in a space. So, a partial on actually works very well when approaching a sort of task-ambient kind of approach because it gives you a nice sort of ambient layer behind a task light.

So, I think you're right. Ideally, what would happen is that you walk in a space and the lighting system is smart enough to know that you actually only need 10-foot candles in there and it comes up to 10, and it doesn't do anything more than that. And it can read

your -- it's like a mood ring or something. It can read what you're doing and, oh, you need more light right now because you're trying to read an 8-point type or something, and so it goes up to a higher light level. That's not going to happen any time soon.

But partial on is the first step towards doing something where you get enough light to actually do something probably adequately well for most general tasks. And if you need more, you know, you can get up from your desk and you can hit the button, and you can get more light out of it.

MR. HOWLETT: Well, I guess the kind of structure that I was thinking about was that spaces, we tend to think of spaces as either being public spaces or private spaces. So, that translates roughly into spaces where people expect that they won't have to hit a wall switch or spaces in which people expect they will have to hit a wall switch. You know, either one of those has got to be true.

So, in the public spaces, where people don't expect to hit a wall switch, in those spaces the controls can automatically switch the lights on to half and then bring them up or down from there automatically.

But in the private spaces, where people do expect to hit a wall switch, then the lights don't do

anything until that wall switch is hit.

And so those are the lines that I was thinking along. All spaces all fall into one, either public or private and, therefore, either partial off or partial on is appropriate.

So, we can sort of narrow down the range of options that way.

MR. MUTMANSKY: Oh, I see what you're thinking, okay. Actually, that's actually a good way to think of it and it would require a sort of restructuring that section of the code to do it, but it would be possible to take that approach.

I mean I agree with you. I considered them to be owned spaces and not-owned spaces. But you're right, public and private there's a line there.

MR. HOWLETT: Yes.

MR. MUTMANSKY: You know, whether you own the switch on the wall or not is sort of how I think of it.

MR. HOWLETT: Right and the code wouldn't necessarily need to make that distinction. We could leave it up to the designer of whether they consider that space to be owned or not owned.

MR. MUTMANSKY: Right.

MR. HOWLETT: You just say you've got to install one of these options and it's up to you to decide which

one works best in that space.

MR. BENYA: This is Jim Benya. Owen, these are really good points. We're going to take this under advisement again. I just made a few other notes here.

I mean we tend -- we have these discussions and we tend to be very office-centric and we have to remember the rest of the world is not necessarily offices. There's industrial facilities, there's stadiums, there's airports and a lot of other places. And I think we can probably come up with a table.

But some of the other points I've made to remind me of things, in the past we've talked about possible ways of measuring actual energy use, rather than watts, and adjusting for that. That's an issue I think we need to take up.

Another issue we need to take up a little bit more seriously is going to be light level choices involving other age groups, for example, or special needs.

And one of the things I do a lot of in my projects is lighting controls where the lighting power varies tremendously over the course of the day, but the actual energy use is very small.

And we need to perhaps maybe be a little bit more sophisticated.

Now, I know some of this isn't going to make it to the 2016 standard and we're going to have to start planning on the 2019 standard to accommodate some of those.

But I think you've raised a point that this needs to be given a quite a bit more look see than some of the other things we've talked about today and that's good.

MR. MUTMANSKY: I think one of the problems that we'd have to solve with this approach is to consider how acceptance testing would work on something where it's sort of being defined by a designer, you know, somewhat may be arbitrarily to whatever makes the most sense to them and not necessarily the most sense to sort of the code. But I think those are things that can be solved.

MR. BENYA: Yeah, that's a good point. But I think, you know, if we go back a little bit to the discussion we had a little while ago, that Rick brought up, maybe we need to put -- again, I don't know if we're going to have time this time around, but certainly by 2019 we can expect a very high level of automation, and a very high level of integration in lighting controls to the point where entirely new approaches are going to be possible both for designing lighting, or saving energy, and measuring the energy that we saved.

And I think we need to start thinking about that. Again, if not this time around, we need to start preparing for a future where that's going to be standard.

MR. SHIRAKH: I need to make a brief comment that to the extent we can accommodate new ideas it's okay, but the primary goal for this round of standards is keeping up with ASHRAE for nonresidential lighting. The time frame won't allow for anything far beyond that. So, that's our stated goal is to stay in line with ASHRAE.

Any other -- Noah?

MR. HOROWITZ: Noah Horowitz, NRDC. Very briefly, we're supportive of the notion of shifting to manual on or partial on. We think that approach is the right one. And to shift away from the fully automatic on is something we want to go away from.

It sounds like there's some nuance that needs to occur to make sure this works in the right way and we hope that dialogue occurs and we land in a good place here. Thank you.

MR. SHIRAKH: Thank you.

Cheryl English.

MS. ENGLISH: Cheryl English at Acuity Brands. I apologize I was late coming in, but there's a lot of

new information on these slides that's not posted.

And so, I was checking and it's still not posted. And if the response date is still the 11th of July, we really need to be able to review this information to provide comments.

MR. SHIRAKH: Yeah, we'll post them by COV tomorrow.

Okay, so no other comments on this measure we'll move to -- we're going to move outdoors and the first topic is Outdoor Lighting LPAs. And the CASE team, Michael Mutmansky is presenting this one as well.

MR. MUTMANSKY: Thank you, Mazi.

Okay, so outdoor lighting -- oh, he's got it up already so we're ready to roll.

All right, nonresidential lighting, outdoor lighting power allowances is the measure.

Go ahead, next slide. A little bit of history here, outdoor lighting was first introduced in Title 24 in 2005. And at that time the LPA values were established based on IES design recommendations.

There was a big mapping exercise that was done to map design criteria to various categories of use for outdoor spaces, including -- well, we're talking essentially about hardscape lighting. So, you know, it starts with parking lots and it goes into dining, and

all other applications out there. There's exemptions, so we're not talking about sports lighting and things like that. That's a whole separate deal.

The values at that time were based on current light source technology and current luminaire technology and standard design practice.

So, that meant, you know, all the standard things, lumen maintenance and lamp lumen depreciation, luminaire depreciation, those kinds of things.

Light source technology at the time, 2005, LED was only being -- only viable in automobile taillights for the most part. I mean, they weren't really even introduced as a white light source at that point.

So, what we were looking at was metal halide as the basis of design because it was about 15 percent less -- had 15 percent lower efficacy than high pressure sodium, and it had lower lumen maintenance values.

So, in the end that was the basis of design that was used for all the calculations.

Go ahead, the next slide. So, onto what we're actually proposing. We want to revise the basis of design from metal halide light sources to LED, project the efficacy of LED up to 2017 and establish new lighting power allowance values for all outdoor lighting allowances.

Fundamentally, we are not making any philosophical change to the design criteria matrix that was established and accepted as part of the 2005 code revision cycle, and was continued through 2008 and 2013.

We are maintaining that same matrix of target illuminances that the IES -- that was mapped and established as part of the IES.

This would impact all outdoor lighting power allowances in Sections 140.7, in the tables in Section 140.7.

And, essentially, it’s a prescriptive requirement but, ultimately, it ends up being sort of mandatory in that as long as you have outdoor lighting you have to meet these requirements.

The next slide; additionally, we wanted to add some language to address a couple of things that were just sort of gaps in the existing Section 140.7.

The first is we wanted to add in an allowance for ATM lighting locations, cash machine locations. And, again, it would be a change.

And this would also actually impact the parking garage -- there’s an exception for ATMs in parking garages, which is actually indoor, but it’s traditionally been treated as part of the outdoor for the calculations.

The next slide; so what we're really talking about is impacting the values in Table 140.7A and Table 140.7B, which is the general hardscape allowance and the additional allowance for specific applications.

These values apply really to all outdoor spaces. The specific applications are layered, typically are layered on top of the general hardscape allowance and are specific to certain circumstances, like gas canopy, you know, vehicle service station canopies, or outdoor retail lots, outdoor retail frontage, things like that. Those are all specific.

Most of those are not tradable. Those are use it or lose it allowances that are tied to that specific application.

The general hardscape allowance is tradable amongst all of the general hardscape outside, but not tradable inside the building at all. So, it's outside only for this.

The next slide; so existing -- here's the existing table as it's currently seen in the code, with the lighting zones across the top, lighting zone 1 through lighting zone 4. Four is the highest illuminance zone. Lighting zone 1 is the darkest.

And it ramps up from, you know, the darker ones being essentially rural California up through LZ 4 would

be downtown areas, very heavily developed.

And at this point, Mazi is that still done as an application basis for use in California?

MR. SHIRAKH: Yes, and as far as I know there are no lighting zone 4s. Nobody has petitioned.

MR. MUTMANSKY: Nobody's done it. Okay, so what we're really talking about here is lighting zone 2 and 3 are just about all of the developed areas of the State.

MR. BENYA: They're the default.

MR. MUTMANSKY: The default.

MR. BENYA: Lighting zone 2 and lighting zone 3, lighting zone 3 is urban according to the census, lighting zone 2 is rural according to the census. Those are the only two default zones.

MR. MUTMANSKY: Right. Okay, the next slide.

Here is Table 140.7B and again there's lighting zones across the top. And down the side are the various special applications.

You can see building entrances and exits on there, primary entrances, drive-up windows. You know, it goes down through each of the specific applications.

And as I said, for the most part these are not tradable. So, if you get an allowance for a building entrance, you must use that allowance within -- this one says 20 feet of the door for that specific allowance for

each lighting zone that you're in.

So, that's more or less the case for most of these is that they have to be used specifically for that application and there's some sort of spatial relationship that applies to where you're allowed to count those watts.

The next slide. Continuing, again more of those just to get everybody familiar with what we're talking about here.

The next slide; all right, current practices, similar to what happens for interior spaces, when an outdoor space is lighted you generally are going to have the opportunity to, you know, essentially look at how much you're allowed by calculating your square footage and looking, you know, essentially running through the calculation process to come up with what your total LPA is or your effective LPA is for your space.

And as long as you're under that number, you're good to go. And if you're butting up against it or if you're over it, you need to back off a little bit on how many bollards you put in or whatever, how many poles, or whatever you have to do, or change your wattage.

As I said, general lighting is tradable so you can shift the weight of the lighting from one area of the developed hardscape to another area, as long as it's

all classified as hardscape, you know, essentially. And there are certain requirements about uniformity that determines whether you're allowed to consider a paved area to be hardscape or not.

Those terms are in there, having to do with five times the mounting height from the pole out is the limit of coverage for each head.

But beyond those kinds of limitations, you're allowed to move watts around on a facility or a hardscape at will.

The next slide, all right so the trends. As we discussed in the morning, light source technology is improving. Pulse start metal halide lamps are better than prop start metal halide lamps used to be. And they are the standard basis of design for the current code, the 2013 code.

And so, you know, things have been moving up the scale.

LED, however, is expected to take over the market very, very soon. And what we're finding is that as the quality of LEDs improves and the efficacy of LEDs improves, these LPA limits that are essentially built into Title 24 are becoming, you know, very, very generous in terms of what you can actually do on a property based on this.

And, therefore, we wanted to essentially recalibrate those values with that in mind.

The next slide, so again this is that same graph. But this time I'm pointing out a couple of things related to metal halide on here and, essentially, where the metal halide numbers started to really improve.

And you can see there is an uptick that started right after 2000. That's when some of the really good quality metal halide products started coming on and the older ones started dropping off.

And the EISA Act kicked in, in there as well, so those values are continuing to move upwards somewhat.

But that graph, the graph to the right, the LEDs, you know, is at a trajectory that looks like a rocket compared to HID.

Let's go to the next slide. And again, this same graph from earlier in the morning. Where we expect to be by 2017 with luminaire efficacy is that the typical LED efficacy out of a luminaire is anticipated to be 35 percent better than the efficacy of -- what this graph is showing is what they're calling top luminaire efficacy for HID and linear fluorescent. Top luminaire efficacy.

So, that line there is the best of those

products and LEDs going to be 35 percent by 2017.

So, if we did nothing but look at it based on efficacy, there is some serious ground to be gained here and it's moving very rapidly as you can see in that graph.

The next slide. Okay, methodology for analysis. We want to apply, essentially, the existing lighting design criteria that's been established and sort of is the long-term basis for this from the 2005, and 2008 and now '13 codes.

Determine a reasonable baseline design conditions. And there's only one real issue of understanding that needs to be discussed here and that is the third point, the light loss factors.

What we decided to do is base LED light loss on a 15-year life of the product because that is our calculation period for cost effectiveness. So, that equates to about 65,000 hours.

And so for light loss, for lamp lumen depreciation we used the 65,000-hour number, not L-70, it would probably be higher than that. It's probably an L-85 kind of number because that's assuming that we're talking about something that's by -- in 15 years' time it's cost effective at 15 years.

And if you get more out of it than that then,

you know, it's sort of a gravy calculation at that point. It goes way beyond what is reasonable to expect out of a lighting system to do.

Beyond that, it's point-by-point calculations to establish LPAs for the general allowances.

And for some of the specific application allowances we made adjustments based on efficacy projections, not based on point-by-point calculations because those are driven more by the amount of light and not based on any kind of uniformity criteria or vertical illuminants.

But overall, what we were doing was doing something based on design criteria. Vertical illuminance is often a controller in general lighting and uniformity is often, also, a controlling factor in general lighting.

So, the calculations actually ran full point-by-point calculations with a variety of light source, you know, from a variety of manufacturers to produce a matrix of results.

The next slide. Energy and demand impacts were done through spread sheet analysis. Obviously, there's no building simulation here. This is all exterior.

And because of that it actually ends up being an interesting circumstance that the demand impacts that we

have are not obviously related to peak demand in general because they're nighttime sort of circumstances. So, that becomes a somewhat complicated thing to address. I mean how do you value those?

The TDV values are also time dependent. And because of that, the nighttime hours of operation are somewhat penalized because they don't have that demand aspect built into them that happens during peak demand.

But even so, I mean cost effectiveness is, you know, calculated with that in mind. So, it's going to be a very conservative number in that respect because the TDV is all based on nighttime hours.

The next slide. All right, so the results, the initial results are, you know, clearly all the LPA values in the tables are going to be impacted.

The range of reductions that we have in the tables are from about 15 percent to, in a couple of cases it was just over 50 percent or thereabouts.

But the average reduction is around 40 percent for the general allowance values in 140.7A. And you'll see that here in a minute.

The next slide. Additional items that we wanted to do, we mentioned -- we mentioned ATMs, that's the second item.

The one at the top is that there's no real

discussion in there about bridges, fly-overs or tunnels. And, in fact, they're exempted.

And what it turns out is that fly-overs or bridges can, in most cases, be considered similar to sidewalks. And tunnels, in most cases, can be considered similar to canopies. So, there's no reason, really, to be exempting those. We might as well actually cover them in an appropriate manner.

So, all we wanted to do was just make -- put a couple little language adjustments in to actually cover them in those respective categories and move on.

The ATMs, we did some calculations and based on the California Banking Code, which has a rather non-lighting definition of what lighting is supposed to look like around an ATM, but we were able to interpret it using a special Rosetta Stone that we found to figure out how to actually properly meet the requirements in the CBC.

And because of that we have allowances for ATM in there.

The next slide. So, as I said, there's not a whole lot of changes to the code language and you'll see that, just a couple of minor word adjustments to add those bridges and tunnels kind of language in there, and the ATMs.

And it's ultimately in 140.7 and then just a little bit in 140.6 for the ATM in the parking garages, since that is actually classified as an interior lighting.

The next slide. So, in the consideration of time I'm not going to get into the specific details here, but this is the 140.6 removal of ATMs as an excluded category.

The next slide. Is that what this -- no, this is what -- essentially, we're adding in tunnels and bridges. And I think there's a typo. Yeah, this has got a typo. It's actually 140.7 on this one. Adding the tunnels and bridges in and removing them as an exception there in that part.

The next slide. And then on 140.7B we want to add ATM locations with an allowance category there.

And the way the code is written it essentially has a single illuminance criteria. It doesn't matter where your ATM is. So, we essentially matched a single set of allowances to all four lighting zones, so it crosses all four lighting zones. And that's just the nature of the way the CBC is written.

The next slide. 140.6C, this is the interior parking garage. We're adding a Note 10 to the section on parking area. And then down in the notes we're

adding a Note 10 that basically gives you a similar allowance for ATMs at the ATM location.

The next slide. Okay, moving on to 140.7B. Again, this is adding the tunnels information to the non-sales canopies. As I said, a tunnel essentially works in the same manner as a canopy, so there's no reason we can't essentially just put that in that category.

The next slide. Again, adding the word "tunnel" to the code, just to include it.

The next slide. All right, so this is where the meat of this section falls. This is the full table of allowances, including -- at the very top is essentially what is in Table 140.7A, those general hardscape allowances.

There's an area wattage allowance, a linear wattage allowance that goes around the perimeter of the lot, and that includes the cutout. So, your building perimeter essentially would probably count as a cutout that gives you additional linear wattage.

And an initial wattage allowance that helps accommodate sites that are very small. There's a certain sort of -- the smaller you get, the less efficient a site is, a site lighting system is that's actually sort of meeting the task on the site.

So, you get initial allowance and then you get additional beyond that for area linear wattages.

What we are proposing, so that the current values are in the left four columns and the proposed values are on the right four columns, and it's a lot. It's a lot of changes. It's going to take a lot for people to absorb it. And we can't get into the details of every single item here.

I'm going to actually go to the next slide, if you can there? And I just wanted to give you the general hardscape allowance values because these are the ones that are -- you know, the overriding one for every site in the State.

And what we did is we did a breakdown of what the reduction looks like for each of these categories for area wattage, for linear wattage and initial wattage, and then across the lighting zone. So, that's what that matrix of values is there.

And you can see that we're looking at -- you know, a couple of them are -- well, the one there is over 50 percent, two of them there are over 50 percent. But most of them are in that 40 to 45 percent range. A couple of them are slightly lower.

But what this reflects, ultimately, is that LED lighting systems are already better, they're more

efficient at producing light and getting the light where it needs to go on a site, and they're more efficacious of a light source. And by 2017 they will be, you know, as we were discussing, 35 or more percent better than the best of the HID light sources out there.

More importantly, what we've found is that the lighting design criteria that the current IES standards have are often controlled by vertical illuminance numbers. And the vertical number is -- so the total amount of light on your site is not necessarily as relevant as the amount of light that you're getting vertically.

And if an LED system is better at producing vertical illuminance you can actually get away with less horizontal illuminance and still meet the design criteria.

Because in many cases, if you don't perfectly balance the system one of the criteria will control, and often it's the vertical numbers that are controlling and not the horizontal numbers.

So, whenever that occurs you end up with ultimately more light on the site than you actually need to meet both the horizontal and the vertical criteria.

And what we're seeing is that a lot of the LED systems are doing a better job of vertical illuminance,

meeting those vertical minimums.

Partly because there isn't that bit pool of light directly underneath the head that the traditional HID source produced.

So in the end all that light that was sort of thrown straight down out of the head is being thrown, you know, 45 to 60 degrees out to the side, or maybe even a little higher. And it was ultimately getting a lot higher. More efficiently, it's getting the light to the zones where it's needed to meet the criteria better.

So, there's these multiple efficiencies happening here that allow us to reduce these numbers considerably and still essentially not be changing the -- we're not changing or reducing the criteria, we're actually just holding the line, just doing it with a much more efficient and efficacious source than we have been able to use in the past.

The next slide. So, as a result, as I was saying, the LED produces something that is really a much more efficient way of getting the light in to meet the criteria.

It is possible to actually meet the design criteria that we're talking about, with the LPAs that we're talking about, with LEDS today. Not even projecting out to 2017, when they're going to be 35

percent more efficacious than they are now.

So, there is -- by 2017, you know, as this graph says, LEDs are going to be approximately 30 percent better than they are today. And it is possible, with some of the best products today, to meet these values without -- well, you know, period, you're going to meet them.

If you have a tough site condition, you might have problems today. But by the time 2017 rolls around, you're going to have that 30 percent boost on all these values, anyway. So, I don't see this as being an aggressive code at all.

I believe that these are achievable values in the context of 2017. And, as a result, they do ultimately represent -- essentially, as I said, we're holding the line or a maintenance change to the code based on how rapidly light source technology is advancing. And this is not an attempt to tighten down or reduce the values, other than just acknowledging and reflecting the fact that the outdoor portion of the lighting industry is very rapidly moving to LED.

And for the most part, the manufacturers that I've talked with, you know, have all essentially acknowledged and are stating that all of their research is in LED. And they are all positioning themselves

very, very well for the big flop to occur when the bottom's going to drop out of the HID market. And it's starting to happen now. Sales of HIDs are dropping and LEDs are shooting up very rapidly for outdoor products.

The next slide and that is it.

MR. SHIRAKH: Thank you, Michael.

Any questions on outdoor lighting applications; in the room? Cheryl.

MS. ENGLISH: Cheryl English, Acuity Brands. Thanks Michael.

Acuity Brands supports the concept of moving to an LED baseline. I think it's an appropriate time to make that step forward and, certainly, the marketplace is adapting quickly to the LED technology.

The Table 140.7A was just provided in the slides that were updated last night, so the numbers -- yeah, it's slide 25, I think it is. Yeah.

The numbers were a little surprising to me. We haven't had a chance to look at the modeling on it.

And number one, I'm very glad you didn't change the models because in 2005 we all spent a lot of time looking at the design assumptions and it's nice that this round we don't have to look at that kind of detail.

But I'm a little perplexed if the only change is going from a metal halide baseline to an LED baseline

why we're seeing such significantly higher reductions in the lighting power allowance in the higher zones.

And I know you mentioned maintenance and vertical illuminance, but I don't understand why those would change more drastically in the higher zones.

MR. MUTMANSKY: Well, a few of the reasons -- well, okay, so in particular there's a couple of lamps that are problem lamps that we've had in the past, 250 metal halides were terrible for lumen maintenance.

MR. BENYA: Still are.

MR. MUTMANSKY: Still are but, thankfully, they are out the door. We aren't using them as a baseline anymore. But we had to in the previous one.

MS. ENGLISH: But those wouldn't have been used in zone three.

MR. MUTMANSKY: Well, yes, they would. Because what we did is we did scenarios where there would certainly have been 400s being used in zone three. There would have probably been some applications with lower pole heights, where 250s would have shown up. And then I don't remember if 150s would have shown up at all. Probably not, but they might have as well.

I mean we were trying to cover, you know, pole heights and lamp wattages along the way.

MS. ENGLISH: Yeah.

MR. MUTMANSKY: It's also possible that they just weren't set as aggressively back in 2000 -- well, whenever we first did the numbers, but these were 2013 numbers.

Well, actually, did we change these in 2013?

MS. ENGLISH: Yeah, but if you're using the same model that wouldn't matter.

MR. MUTMANSKY: Yeah, that's right.

MS. ENGLISH: So, I appreciate, you know, there's a lot of detail and we can't completely address it here today, but that's just my observation is I'm struggling to understand why, specifically, you know, LZ3, but the higher zones seem to have much higher reduction levels in lighting power allowance than the other zones.

And so, I guess I would like to request that, you know, you post the models, just like we did in 2005, so that we can all actually take a look at what was used and be able to comment more appropriately on that.

MR. MUTMANSKY: That's fine. Actually, a lot of these things are -- they're fresh off the presses.

MS. ENGLISH: Sure.

MR. MUTMANSKY: So, there's a reason that they haven't been distributed widely at this point. So, we're happy to do that.

MS. ENGLISH: Yeah, and on that particular area because that is a complex set of data and a complex evaluation. I do think that we may need to look at a longer time frame than July 11th to comment on those models, and the assumptions in there.

MR. MUTMANSKY: Okay.

MS. ENGLISH: And I did want to just clarify, because you mentioned many times a range of 35 percent increase in the product efficacy by 2017, but your models are based on current technologies today. Is that correct?:

MR. MUTMANSKY: No, these models were calculated using projected 2017 values.

MS. ENGLISH: Okay.

MR. MUTMANSKY: But we back -- we sort of checked them backwards to see whether they were achievable today.

MS. ENGLISH: So, I find that questionable whether or not that is appropriate within the Title 24 process to make assumptions about what product performance is going to be in the future. I believe it has to be based on current technologies.

MR. MUTMANSKY: Right. So, you know, the problem that we have is that Title 20 -- or LEDs are advancing so rapidly that if we do calculations today

based on, you know, 2014 values, set them based on 2014 values for 2017, we're essentially two and a half or three years out of date.

And this code will go from 2017, essentially, until 2020. So, now we're talking about something that's six years out of date.

MS. ENGLISH: Yeah.

MR. MUTMANSKY: And with LED, you know what that means.

MS. ENGLISH: And I'm necessarily opposed to that. I appreciate where you're getting at with that.

MR. MUTMANSKY: Yeah.

MS. ENGLISH: I think procedurally we just need to make sure that what you've done is within the procedures for the Commission.

MR. MUTMANSKY: And that's why I wanted to be clear about that.

MR. SHIRAKH: In the past we have set the standards based on projections as long as we had reasonable assurances from manufacturers that those products would be available.

I do understand that, you know, it's a little bit looking into the crystal ball.

MS. ENGLISH: Yeah, it's a slippery slope.

MR. SHIRAKH: But we've done it in the past, but

very cautiously. So, you know, if there are concerns about the projections from manufacturers, we'd like to know about it.

MS. ENGLISH: And we'll obviously be able to know more about that when we look at what the assumptions are in the long run.

MR. SHIRAKH: Right. And I think your other comment about lighting zone three is right on, I had the same comment when I was looking at it. You know, if you're -- all we're doing is changing the baseline, you know, why is the percentage different for some of these other climate zones.

So, you know, we need to make our models available for Cheryl and others to see.

MS. ENGLISH: I had a question on the tunnels. Is the coverage and including that really the scope of what's covered under Title 24, so it would not include tunnels covered by Caltrans because that's outside the scope.

MR. MUTMANSKY: Correct.

MS. ENGLISH: Okay.

MR. MUTMANSKY: It's no roadway lighting or anything like that. It's just, you know, on-site, on-property kind of things.

MS. ENGLISH: Okay. And then my last comment is

just an acknowledgement of the values being proposed here to promote energy efficiency have been supported by industry with our efforts to help get the clarification in the IES RP20 draft revisions, which we're going to significantly increase the illuminance levels required for outdoor lighting.

So, because we've been able to take that back and get more detailed evaluation, this has allowed these proposals to move forward.

Thank you.

MR. SHIRAKH: Thank you.

Jon?

MR. MC HUGH: Yeah, Cheryl, could you describe a little bit more what you mean about RP20? Are you saying it's being delayed or are you saying that there's now a more inclusive membership and process that allows people to take a broader look than just what would appear to be kind of a fairly narrow process, originally?

MS. ENGLISH: Yeah, I can't speak specifically to the root cause of what happened because I don't know, and I don't think it's been determined, yet.

But there was clearly a disconnect in the tables that were proposed versus the technical data supporting them. I don't know if it was, you know, administrative

errors or what, but it has been sent back to the committee, the same committee to review, reevaluate, and resubmit.

MR. MC HUGH: And do you happen to know a timeline or is that not clear?

MS. ENGLISH: That will be up to the work of the members, the volunteer members of the committee.

MR. MC HUGH: Okay, thank you.

MS. ENGLISH: I think I can feel assured that it won't happen within the time frame of what you're talking about for Title 24.

MR. SHIRAKH: Thank you, Cheryl.

MS. RAINER: Becky Rainer with Eaton Cooper. The RP20 revisions were sent through, actually, just this morning. We expect to have those back to the board sometime the first or second week of July.

MS. ENGLISH: Well, there you go. That's great.

MR. SHIRAKH: So, are the illumination levels going to be way different than the current RP20?

MS. RAINER: I can't really say what the changes are. I can just say they are significant and there have been some revisions. As Cheryl noted, there were some discrepancies and some miscalculations, so there will be some changes.

MR. SHIRAKH: Okay, thank you. Good update.

Noah?

MR. HOROWITZ: Noah Horowitz with NRDC. I want to initially recognize all the great progress the industry has made in its shift towards energy-saving LEDs that appeared to happen almost overnight.

We support the recalibrating of the LPA values using an LED baseline.

And my understanding is we assume the same illumination levels. And until we hear otherwise, I think that's the right way to go.

And we need to make sure that new levels that might come out of industry recommendations don't result in overly bright areas.

I would like to see some sort of overall summary. When you roll this up, what's the impact of this measure and other measures in terms of the kWh per year first year, and over the measure life, and the Mw savings to better understand, you know, what are we going to get from residential proposal? What are we going to get from this outdoor lighting to help put our arms around it and understand where the give and take is, and where the points of emphasis, at least for us, might want to be in terms of getting the most energy savings possible?

MR. SHIRAKH: We do an impact analysis once we

have all the measures and that will capture the kW reduction and kWh from various res, nonres, outdoor lighting. So, you know, it would be something that we have to do.

MR. HOROWITZ: To the extent we have draft numbers where we could roll things up now to understand where things are, I think that would be helpful.

MR. SHIRAKH: Okay.

MR. HOROWITZ: I understand in the overall impact report those will be there.

There was one other point. I think that's it, thank you.

MR. SHIRAKH: Okay, thank you, Noah.

Any other comments in the room? Jim?

MR. BENYA: Yeah, Jim Benya. I'm going to add a few of these as we haven't -- we didn't have a chance to go over any of this, either, before. So, I want to throw some of these on your plate.

Number one is to add lighting zone zero so that the lighting zones match the IES handbook.

Number two, make sure it's coordinated with BUG, because the BUG reading system for outdoor luminaires is part of the discussion these days. So, keep that in mind.

What BUG has, as Michael you well know because

you were there, BUG has the net effect of reducing the wattage per luminaire, or the lumens per luminaire, more specifically.

And that reduction in the number of lumens per luminaire may affect the -- certainly, the efficiency of what we're comparing things, both plus and minus because metal halides were equally limited, too.

But the BUG system was not necessarily part of the standard 2005, 2008, 2010 process, but it is now. So, plant that seed.

One of the things we may want to discuss is the impact of ATM, tunnels, and fly-overs, and some of the other areas. You know, one of our requirements, legal requirements is to demonstrate something has impact. And we can't regulate every last little thing.

I think it's a great observation. You picked up these areas where we weren't regulating before. In the past we've discarded ATM lighting as not having enough impact. So, that may be a reason not to enter it into the standard.

So, give some thought as to how many ATMs and how much energy would actually be saved by a code requirement and you may not find it's much.

But some other things that I'd like to express some concern about, and this is going to throw a wrench

in your works to a certain extent, is the evolving understanding and concern about the extent to which blue light in outdoor lighting is environmentally problematic.

And there's an article in *SSL Magazine*, by Kevin Willmorth, which summarizes this extremely well, May 2014.

But the problem is that the low color quality, high correlated color temperature LEDs that are becoming unfortunately common in outdoor lighting are actually, maybe contributing very significant to environmental impacts, as well as human health impacts.

What I think this is going to do is we're going to see a slowing down in the race to put high color temperature, low CRI LEDs into outdoor environments, and we're going to start to see an increase in lower color temperature, higher CRI in order to get rid of that excessive blue overshoot of the low CRI LEDs.

When that occurs, your lumens per watt, that you're factoring in right now, your calculations are going to go down quite a bit.

And so, these values may in fact may be based on a technology that has environmental negatives and very serious ones.

So, I think we need to keep that as part of our

discussion as to this -- you know, the relevance of that.

Likewise, that blue peak also causes glare, excessive glare. And it is well-documented, now, by a number of learned papers. Ian Ashdown just sent me a bunch to read. The blue spike of low CRI LEDs is actually contributing to the excessive glare response of LED lighting.

We happen to be going through this very series of questions and problems in the City of Davis right now, as Davis has put in LED street lighting. There's been a very strong community backlash, both against the glare and the color.

So, these issues, I think, are prominent. They're going to continue to show up. They're not going to go away.

And so, if these values are based on 60 CRI, you know, 5,000 k LED light sources I think we need to prepare a backup table for a light source that may have 25 or 30 percent fewer lumens per watt.

Finally, of course checking to make sure that all of the values, once completed, can meet the IES recommendations in the 10th edition handbook because we really didn't do that, I don't think, with the 2013 standard.

I think the handbook came out too late for a CASE report on that. And so, what we've got is the 2013 standard was based on, as I understand it, our cumulative best guesses as to what IES recommendations would be prior to the 10th edition handbook.

But I think we need a fairly comprehensive cross check to make sure we are in fact meeting the handbook recommendations.

I know that I've personally designed a number of LED outdoor lighting systems and there is significant energy to be saved compared to metal halide.

And the way you described it, Michael, was very correct, major advantages over uniformity of distribution, significantly improve peripheral, vertical illumination, et cetera.

My concern is that that is achieved using light sources that have significantly more environmental impact, negatively speaking, and more glare.

And that is going to be the issue of the year next year, and the year following, I think, in outdoor lighting.

So, keep that in mind as we work on this that we need to be anticipating some issues that really are not so much in the public view right now, but they will be.

MR. SHIRAKH: Thank you, Jim.

Noah, and then Cheryl.

MR. HOROWITZ: Noah Horowitz, NRDC. I just want to combine two different threads that I heard. One was do you assume the baseline of today's efficiency of LEDs or in 2017.

And I heard Jim say, hey, we want to move away from the high CCT, low CRI bulbs, and that comes at an efficiency hit.

So, we have to be real clear, apples and oranges here. We are going to get more efficient LEDs. So, are we looking at a 2017 time frame of more efficient LEDs, and also the better CRI and CCT, or are we going to look at both the bad cases here? So, let's just be real clear what the assumptions are, whatever we do.

MR. BENYA: Yeah, just a response to that, one of the major issues, a series of papers that are now coming out now has to do with LED array glare. And it's now being identified as significantly worse per lumen of luminaire lumens than any other glare we've ever experienced.

I've called it pin cushion glare for several years now because it's basically a lot of sources that are about -- many of them are 15 percent as bright as the sun, okay. And when you put a group of them together, the glare is a lot different than anything

we've experienced before.

Now, they're really beginning to study it and finding this is pretty severe stuff.

I think that it's exacerbated, of course, by the blue content. But the glare of the individual LEDs, themselves, is a problem.

Some manufacturers are beginning to look into luminaires that reduce that, with lenses and other media.

Once you start doing that, the luminous efficacy may stay high, but the luminaire efficiency is going to go down.

And we may need to give up a little bit there, too. In other words, we're causing problems by enjoying the enormous efficiency of these light sources, but now we're beginning to render some practical problems.

So, I wouldn't be quite so aggressive at embracing all that they can do, yet. And I personally believe these are going to be issues that are going to be a significant part of the discussion of the IES and the lighting community for the next two or three years.

MR. SHIRAKH: Cheryl English and then, Michael, you can respond.

MS. ENGLISH: Cheryl English, Acuity Brands. To respond to some of Jim's comments, related to the BUG

rating, and Michael, and Jim and I lost many years over the development on this, so I think we all feel the pain.

But you will recall that BUG ratings were intended to compare fixtures and fixture performance. And that if light pollution is what we're trying to addressed, then it needs to be addressed in Title 24 from a performance basis.

Because just because you select the right up light and glare does not mean you're going to minimize up light and glare on a fixture-per-fixture basis.

Title 24 already has the up lighting glare requirements in there.

But I think that I am getting more and more concerned with each iteration of Title 24 that it's getting too prescriptive about the products and not enough performance-based about the applications.

So, if light pollution and glare is what we want to address, then we need to do it from a performance basis, and we've got the modeling already set up to do that.

On the blue light issue and high color temperature, there is a lot of research that is going on relative to this area. There are a lot of variables. There's, unfortunately, some misconceptions about some

of the health impacts. I'm not suggesting that there aren't some credible things there.

But light at night has been conceived as outdoor lighting and it may or may not be root cause of some of the health-related issues because it really is based on third-shift workers and the detail of time duration of exposure, color, spectral characteristics.

So, I guess really to reiterate some of Noah Horowitz's comments, if we go down this route, we're going to basically take back all the savings that we're talking about here from an energy efficiency stand point.

And I think we just need to be very careful in not over -- preceding ahead of what the research is really telling us at this point.

I think it's a very interesting and intriguing areas that we do need to follow. And if we're going to set limits, they should not be overly aggressive until the research is fully vetted on this.

With regard to the 10th edition handbook, I agree. There was a lot of estimates on what we were assuming were going to be the illuminance levels, so we should go back and validate that.

Okay, thank you.

MR. MUTMANSKY: So, just to follow up on the

10th edition handbook. We did do a review of the 10th edition handbook. We did a matrix, a very, very big table of values.

One of the things that we found is that some values in there were drastically changed from where they are in our design criteria tables downward.

In particular, auto retailing lots and frontage were a third of the value that I think, if I remember correctly, of the ones that we are using right now.

We chose at this point to not make a change to that simply because that wasn't really where we were charged with going with this, so we didn't make those specific changes.

But for the most part, most of them match up reasonably well and I can share that table with you, and we can go through it.

But there were some changes in there, for sure, that aren't explicitly covered in here.

But the other issues that I wanted to comment on is something that, Cheryl, you both talked about is this issue of whether or not we should be accommodating the higher efficacy values of low CRI LEDs.

And we did these calculations based on 4,000 kelvin LED. So, not the worst offenders, not the 5,000 or 5,500 kelvin LEDs, but we weren't doing these based

on 3,000 kelvin LEDs, for example.

And that's to say nothing about the CRI values which is, you know, they just aren't even available right now in outdoor products in the higher CRI values for the most part.

So, there's certainly some room in there for us to do that. My concern, however, is if we suddenly design everything based on an extremely inefficient -- in the range of LEDs, an extremely inefficient LED system, high CRI, low color temperature LED, such that we're taking a 30 percent hit, there's nothing in the code that eliminates the ability of a specifier to use all of the -- you know, the "bad products" that you're referring to that are the sources of possibly light pollution, and glare, et cetera, and the melatonin production issues with blue light.

What we did is just ultimately leave the door open for even more of the bad stuff by doing that.

So, we have to decide how we set these values to accommodate both the good quality equipment and the equipment that might have higher efficacy, but also with the tradeoff of, you know, much poorer, say, glare control, and like trespass concerns, and et cetera.

Lastly, we did actually include the BUG in our calculations, or not the backlight part in most of the

calculations, but the U and G were intended to meet in each of the LZs when we did our calculations.

So, if it was not a -- if it didn't meet the UG requirements for LZ1, it wasn't used as a product to do calculations.

MR. SHIRAKH: May I ask why color rendering is important for outdoor?

MR. BENYA: Jim Benya here. It's marginally important for outdoor lighting because if you can look at something and see it, you're seeing with cones. Fovial vision is how you see something.

Peripheral vision which is, essentially we all think of it as black and white, is motion based.

And it's been believed that it is your peripheral vision causes your fovial vision to occur. Your attention is drawn to what you're trying to see.

So, color discrimination in outdoors is of some interest. I haven't heard anybody say it's all that critically important most of the time.

The issue really here is in the low CRI LEDs they -- they achieve high-efficacy by allowing a lot of the blue, the original blue of the LED through without turning it into some other color through phosphor.

So, it's a thin coat phosphor, you get a low CRI, but man you get a lot of blue light because the

process of converting blue light to another color through phosphors takes energy.

And just letting the blue through, man, you get it all.

So, you can achieve really high-efficacies with very low CRIs.

It's been said by one of the scientists at Soraa, which is a California-based LED manufacturer, that over 80 -- he was talking in terms of higher CRI sources, that for over 80 CRI, for every point of CRI it costs you two lumens per watt.

So, to go from 80 to 90 it's going to cost you 20 lumens per watt.

Who's going to use an LED that's 20 lumens per watt less if they don't have to?

And so, needless to say, we're using 65 CRI LEDs and lower for street lighting and other outdoor lighting jobs because the efficacy is even higher.

And that is the issue that I'm trying to bring up is that Cheryl's absolutely right, this is a topic where there's a lot of research being done. There's a lot of misinformation and misconceptions.

But at the same time there's also a lot of information and conceptions. And it is a legitimate issue of the day, and of the year, and of the next year,

and the year beyond that, I'm sure.

So, I'm just bringing this up so that we have a strategy for dealing with this, because I don't think we do, yet. I don't think we're ready for it. I think you've done a good job of taking us, if this weren't a problem, to where we need to be.

Now, we've got to figure out if this is a problem and how we're going to deal with it.

MR. SHIRAKH: So if blue light is the concern, is the proper mechanism to deal with that -- is it color temperature or CRI?

I mean what if we -- and you mentioned, Michael that your assumption is 4,000 degrees kelvin. If you're not worried about -- if we don't worry about CRI and we use 3,500 or 3,000 what penalty are we talking about in terms of efficacy?

MR. MUTMANSKY: Well, what I do know is that going from 5,500 or 5,000 kelvin to about 4,000 drops about 15 percent of the blue light out that Jim's talking about.

Going down to 3,000, I don't have the number off the top of my head. Do you know it, Jim?

MR. BENYA: Well, it really depends upon the Color Rendering Index at that point.

MR. MUTMANSKY: At that point, yeah.

MR. BENYA: CRI is not the most perfect measure, like we talked about this morning, but as you increase the Color Rendering Index you're taking blue light and converting it usually to red. Because it's a lack of red is what is prominent in most LEDs.

So, you're taking -- to improve the red, get the R9 values up, you're taking that blue energy that would ordinarily just go out and stealing it to make red, and in the process reducing the blue, increasing the red, and making it match the black body curve better. All those good things happen.

But the penalty is there, you know, give or take two lumens per watt for each CRI point, and when you start talking about the difference between 65 and 85 or 65 and 90 that's a lot.

And that's what I'm calling attention to as a concern.

MR. MUTMANSKY: So, are you proposing that we consider some kind of minimum performance specification for outdoor lighting that falls in -- something in line with JA8 in that there's some specifications for CRI, possibly color temperature. You know, maybe not some of the other aspects, the flicker and other things, but some of the non-purely energy-related values?

MR. BENYA: Well, because there's environmental

impacts well beyond human health that are getting to be pretty widely understood and pretty widely agreed upon.

This has, you know, a significant impact on our State with all forms of wildlife. And so, this is something we have to take a bit more seriously even than just humans.

Because Cheryl's right, the misinformation about human health and all that it gets us going off in the wrong direction. We have to look at the entire impact range of this, potentially.

So, the simple answer to the question is I don't know. Maybe we do need a California quality outdoor lighting standard.

But this goes in the direction and I'll say it, because before Mazi does, that this is the California Energy Commission and we work under the Warren-Alquist Act, and it's not an environmental standard.

MR. MUTMANSKY: Okay.

MR. SHIRAKH: Thank you.

Go ahead, please.

MR. COOK: Keith Cook with Philips. I think we do need to be careful here because I do know of some studies that have actually shown just almost the exact opposite.

CRI is not a good measure on the outdoor, as

previously stated.

But there is a factor called vividness and there have been a lot of studies in outdoor lighting that shows that actually the higher CCT, the cooler temperatures have allowed you to see better at night than with the lower CCTs, the redder colors.

And, in fact, it's allowed them to reduce the energy levels beyond what the recommended practices were because the eye was able to discern objects better with the higher CCTs.

So, we do need to be careful with this one.

MR. MUTMANSKY: Right, so you're referring to mesopic vision and the SP ratios, and things like that, right. Okay so, you know, Jim and I are both very aware of that.

We did not actually take mesopic vision factors into these calculations, which could actually reduce them even further.

The range, to my recollection, in the range of luminances that are typically found in parking lots and other things puts us in that about 10 percent range, if I remember correctly.

But those are not part of what we actually did here partly because -- and I think the science is not settled on that, yet. I mean there's been some research

to support it. There's also been some research by LRC and other places that, you know, refute it a little bit, or a lot.

But I agree with you that there are actually some additional benefits that could be had with blue light.

Unfortunately, what Jim is discussing about, you know, the negative impacts are still there even if we have this positive benefit of higher central vision associated with that blue light.

So, there's a balancing act here and it's gotten much more complicated than anybody probably anticipated five years ago when we started doing a lot of that research on it. So, thank you, though.

MR. BOESENBERG: Alex Boesenberg, NEMA. Just one note or a suggestion from Michael and Jim, when we started talking about what color works outdoors here in California, and all that, my mind immediately went to someone I used to work with, Ed Ebrahimian of the City of Los Angeles.

I think in terms of knowledge base in California about how to get LEDs right and get people satisfied with them, he's a resource you would do well to tap into.

MR. MUTMANSKY: Thank you for that, Alex.

MR. SHIRAKH: Jon?

MR. MC HUGH: So, just going back a little bit to the discussion about so what is the lighting basis that we use for the standards?

And my recollection is that the work that Michael's done in the past has -- basically, there's this huge array of recommended light levels from IES, based primarily on the LMs.

And so the question is, you know, potentially and I think you actually found, that the handbook conflicts with the LMs in some cases.

And so the question is what do we actually use? You've got -- if we're on the same sort of -- you know, IES is considered the cognizant authority on setting that baseline, but their own -- you know, I think what's been found in the past is even within the various LMs, and then comparing the LMs in the handbook, between all of those things that there's conflicting information.

So, do we actually have some kind of guidance on this or is it essentially just trying to sort of, you know, figure out -- you know, picking some things from one place or another?

So, you know, Jim had brought up, you know, using the 10th edition handbook. I don't know if that really satisfies, you know, the whole consistency issue.

So, just wondering what should be the basis.

MR. BENYA: Jon, you know, I've been really involved with the IES system, particularly with respect to outdoor lighting for, you know, about 12 years now.

One of the things that -- what the 10th edition handbook did is it was the definitive time or the definitive step at which the five-lighting zone system was adopted.

It was the definitive step at which the single compendium of all outdoor lighting recommendations as of 2011, were made on a five-lighting zone basis.

There were several recommended practices that were outstanding. That's RPs, not LMs, recommended practices. And there were several RPs that were outstanding and not cited in the handbook, roadway lighting, a very significant one and parking facilities, which are affecting the work today, RP20 and RP8.

Those two recommended practices will be coming out soon and will have additional impact upon us.

So, in other words, the most recently issued document is the one that we should be going by.

If there are differences between them, the first step is to go with the most recently issued. And if that doesn't resolve the matter, then we need to discuss it.

But that's historically the way we've done things and I think it will suit us just fine, I think for most of what's coming up that I know of.

MR. MUTMANSKY: And historically, when we did that matrix back in 2004, or '03, whenever we actually did that for the 2005 code, we discovered this huge set of discrepancies that there were, at the time, you know, sometimes three different recommended practices that had disagreeing recommendations on the same design criteria for whatever, sidewalk lighting, whatever you want to call it. There were sometimes multiple sources out there.

The IES, that was sent up to leadership at IES and they very quickly recognized that this was a problem and got on it, and started to get their RP committees, you know, the committees onboard to get on the same page with that.

And that was also the same time that the lighting zones were implemented in large scale.

And as Jim said, the most recent handbook essentially addressed that. Sort of that was the final step in addressing that.

As he mentioned, RP8 was not included. I believe, though, that RP20 is sort of in there, like it gives you a method of doing it. It's not explicitly

listed, but there's a way of actually going through the calculations and getting some recommended values in there.

But it's not very effectively done and that's the reason that, you know, we're looking at this new RP20 that's -- you know, was theoretically coming out this summer, but may be delayed by a couple of months now.

Otherwise, I think for the most part the values that are in the handbook, as I said, pretty much coincide with the current or the most current values in the RPs for the various outdoor conditions.

The big exception that we saw was what used to be the old RP2, the retail lighting recommendations, which were radically reduced in the most recent handbook.

MR. MC HUGH: And you're not planning on using the handbook, though, for the RP2s? You're being more conservative and using the RP2 values, is that right?

MR. MUTMANSKY: Yeah, we felt that at this point it wasn't a change that was -- that could be made in the context that we're already reducing these allowances by a lot in many cases.

And if we were going to take a couple of other allowances in there and then double down on them, and

reduce them down even further I mean it would be a shocking number.

And it would have been very selectively applied and it just didn't seem like it was an appropriate way of approaching this.

We feel like it's more appropriate to do a two-step process. Let's get the LED baseline going first and then we'll -- you know, in the next round then we'll go in with the rest.

MR. MC HUGH: So, just to follow up a little bit, I know that in prior rounds of the standards we had received comments from lighting designers that they couldn't believe how high our values were for, for instance, gas station canopies, which was based on RP2.

And I was wondering if you had looked at that and if, indeed, the handbook had addressed those canopies.

Because as I remember, we were using things like, you know, 2 watts per square foot or, you know, pretty high values for canopies.

MR. MUTMANSKY: My recollection is the canopy values have not changed, but I don't want to misspeak on that, so I'd have to defer and check back again on that. Because I don't recall that one being one that we noticed as being --

MR. BENYA: Actually, that's one I would love to see us go after.

MR. MUTMANSKY: Oh, me too. I mean that's one of the highest ones there is.

MR. BENYA: Well, the history of it was interesting because we had the Gas Station Lobby was in here when we were developing that standard and they were screaming how you had to have, you know, 100-foot candles under the entire drip line of the canopy.

And the same company that came in and was swearing that was true, five years later adopted a task and ambient approach for all the canopies so that they could sell new lighting, and the average levels had dropped significantly, the power had dropped significantly.

They are now selling LED lighting systems with even less wattage requirements.

So, we can basically go back to the standard practices of the industry to get to that one, I think. And I think we could see significant reductions.

MR. MUTMANSKY: Well, and that would be a case where we would need to explicitly not use recommended practice or the handbook to do that. We'd have to go to standard practice and see where things are out there.

MR. SHIRAKH: I just want to put my standard

note of caution that for this cycle we're limited in what we're attempting to do.

I want to move to the last topic, so we can get out of here, yeah, Outdoor Lighting Controls.

And Michael Mutmansky, are you doing it?

MR. MUTMANSKY: No, it's McGaraghan.

MR. SHIRAKH: Oh, okay.

MR. OWNBY: Is that the appropriate one, Nonresidential Lighting Outdoor Lighting LPA?

MR. MC GARAGHAN: No, it's actually Outdoor Lighting Controls.

Anybody want to get up and stretch, feel free. We need a minute here.

Okay, great, thanks everybody for sticking around for the last topic of the day.

This is a proposal to update the controls requirements for two very specific outdoor space types, outdoor sales canopies and outdoor sales lots.

And one of the things about this measure, it's probably more -- it's earlier in its stages than some of the other measures presented today. There's a great deal of data collection that's still ongoing, that we want to make sure happens as much as possible in the course of this measure.

So, we're continuing to explore it. The IOUs

are still very much interested in pushing this measure forward, but it's not at the same place as all the other measures.

So, we're really looking forward to stakeholder contributions, additional data points that we've not been able to find so far.

So, I'm glad people are here and there definitely are going to be some requests of stakeholders.

So, jumping in, the proposal would be a nonresidential mandatory measure to streamline outdoor lighting controls requirements.

So Maxi mentioned that one of the things they're tasked with on the nonres side is keeping up with ASHRAE.

Another thing they're pursuing is removing exceptions wherever possible to streamline the code.

So, that's essentially what's going on here. These two space types, outdoor sales lights and sales canopies are exempted from one of the controls requirements and we're proposing to remove that exemption.

We're also looking to reduce the minimum allowable dimmed level for these space types or for all space types using multi-level dimming controls.

The next slide. So, it will improve upon the current requirements. There's additional savings opportunity out there. Existing requirements specify automatic scheduling control and a part-night control, but it doesn't specify the amount of time that controls need to spend in a dimmed state or an off state.

So, it's getting at additional nighttime occupancy savings.

The other rational here is that the industry has changed, as we've been discussing it's moving to LED, so it becomes easier and easier to control these systems.

The next slide. So, definition of an outdoor sales lot is an uncovered paved area used exclusively for the display of vehicles, equipment or other merchandise for sale. So, that's mostly talking about auto sales lots. And our research found about 7,000 of those in the State.

And sales canopy is a canopy specifically to cover and protect an outdoor sales area. And that's almost entirely fueling stations, and we found 10,000 of those in the State. So, there's a sizeable market out there.

The next slide. Occupancy control systems currently exist for all technologies, metal halide, HPS, LED. Of course, they're optimal for LEDs and that's

where the market's moving. And as we just heard from Michael Mutmansky's presentation that's the baseline he's assuming for the LPA requirements for outdoor lighting.

So, that's what our assumption is, too, the market is going that direction. LEDs offer a lot more customization, deeper dimability, quicker responses, et cetera, so a lot of advantages to moving to LEDs.

In terms of controls configurations for outdoor spaces using LEDs, we are looking at both circuit-controlled, like occupancy zones, and integrated fixtures. Either would meet these requirements. Either currently do meet the requirements for other space types.

The next slide -- actually, can you go back to the last slide for just a minute?

One thing I would just point out is that occupancy controls in outdoor spaces are already required for the majority of outdoor space types and we have quite a bit of experience installing them.

The State has sponsored a lot of projects. My company has worked on a lot of projects. We've got hundreds of audits sort of, you know, in our track record and we've been monitoring a lot of sites.

So, for parking garages, parking lots, walkways,

a lot of outdoor space types we know pretty well how dimmed occupancy sensing controls work.

One of the reasons that I've said this measure is still very much in development and we're -- and the data collection process is that we want to make sure we understand how those controls would work in sales lots, specifically, and sales canopies specifically.

And we don't have that measured data, yet, so that's one thing we're still looking for.

The next slide. So, what the current code requirements are, are listed here. There's basically four layers for outdoor lighting spaces.

The first is basically photo control or astronomical time switch to make sure lights are off in the daytime. So, that's Item 1 of Section 130.2C.

The next, Item 2, is for the outdoor lighting must be circuited separately, or independently, and be controlled by an automatic scheduling control, pretty straight forward.

So, let's go to the next slide that shows Part 3. Part 3 of the outdoor controls requirements is the motion control, essentially, multi-level motion-sensing controls.

And that has a series of subcomponents. The one highlighted there explains that the controls should be

capable of reducing lighting power of each luminaire by at least 40 percent, but not exceeding 80 percent, or providing a continuous range throughout that range.

Employ auto on when the area becomes occupied and no more than 1,500 watts controlled together.

So that, those three requirements apply to all outdoor spaces right now, except for a handful that have exceptions written into the code.

So, the next slide. Exception 1 to Part 3 says that if you're outdoor sales frontage, outdoor sales lots or outdoor sales canopies, those do not have to meet that motion-sensing control requirement.

Instead, if you're one of those three space types, you have to meet Part 4. And Part 4 says you either have to install a part-night control, a part-night outdoor control or do the motion sensing.

So, you can still do the motion sensing, if you want to, but you do not have to if you're a sales frontage, sales lot or sales canopy.

The next slide. So, the current definition of a part-night outdoor lighting control is a timer occupancy-based lighting control device or system that is programmed to reduce or turn off the lighting power to an outdoor lighting luminaire for a portion of the night.

So, a part-night outdoor lighting control is pretty clearly defined. And what I'm actually thinking, and I've talked to a handful of people in this room and stakeholders about this, is that a part-night outdoor lighting control might actually already meet the requirement of an automatic scheduling control which is, as you recall, Part 1.

So, there might be some overlap in the code language here. We want to clear that up. But what we're proposing here is to not require this as a separate control device because it appears that it already would meet the definition of automatic scheduling control.

The next slide. Just this is another thing to point out in terms of exceptions to all of these code requirements. There are wattage thresholds. They don't apply to wattages -- pole-mounted wattages above 75 -- I'm sorry, below 75, or non-pole-mounted luminaires below 30 watts.

The next slide. So, in terms of the proposed code changes, they're actually very simply and short.

On this page we're looking at Part C, Items 1, 2 and 3, and the only change there is that we would allow dimming to a greater degree. With the onset of LEDs, deeper dimming is possible, so we didn't want to prevent

that or exclude that, so changing that from 80 to 90 percent.

And then on the next slide we'll see the exceptions. The only other proposed changes at this point are removing the terms "auto sales lot" and "outdoor sales canopies" from the list of exceptions to Part 3.

And then in Part 4 removing those terms again, because they've just been covered by Part 3.

So, the only sales type or space type that would still have that exception and not have to install the multi-level lighting motion-sensor controls would be outdoor sales frontage.

The next slide. So, the next few slides I'll just run through a little bit about the analysis that's been conducted so far and some of the items we're still working on, and the things that we are hoping to get feedback on.

But so far we've done spread sheet analysis that assumed LED technology as a base case and plugged in assumptions for occupancy trends in outdoor sales lot areas and sales canopies.

We've used previous case analysis to characterize very similar prototypes for those two cases and put that all together to project energy savings,

first year energy savings and 15-year TDV savings.

The next slide. In terms of cost effectiveness, we've collected some cost data from a couple of distributors, or retailers, and stakeholders and developed incremental costs specifically for these types of controls.

And actually, as we'll see in a minute, have found in using the assumptions that we plugged in, found cost effectiveness in all prototypes.

The next slide. So, here's where it gets into the part where we'd really appreciate input. But right here we lay out a number of prototype facilities.

We've modeled four different sales canopy prototypes, including two larger sales canopies and two smaller sales canopies. The difference there is that in each case we've modeled a 24/7 facility and a facility that's open primarily in the daytime.

And then the fifth prototype is a small outdoor sales lot, knowing that there are many sales lots out there that are much larger.

And that one we assumed is open just pretty much 8:00 to 8:00.

All of those operating hours are based on research that our CASE team has done.

The next slide. So, in developing the model we

had to make a lot of assumptions. Without having measured data, yet, of how sales lots and sales canopies, the occupancy patterns throughout the night, we've plugged in assumptions as placeholders for now, and we want to see -- you know, we'll get people's input on these.

But for the dimmed level, we're assuming 60 percent, which is right in the middle of what the code currently requires. It requires anywhere between 40 and 80, so we've picked 60.

In terms of the fixture wattages, for canopies we're assuming a high case of 122 watts and a low case of 82 watts.

For sales lots 202 watts and 126 watts. And those are, again, pretty conservative assumptions on our part. We believe there are plenty of fixtures out there that will use more wattage than that.

These are well below, if you calculate the power density from these fixtures, they'd be well below the proposals for the lighting power allowances.

So, these are, you know, lower-wattage systems that we've modeled just for the sake of showing is this measure cost effective in all scenarios.

Sensor activation and response times, we've assumed that four minutes would be a setting after a

space is occupied, before lights would dim again.

We also assumed about four and a half to five minutes per occupant, per gas station. Basically, how long it takes to come in, fill your tank and leave again. And that's based on a number of studies that we've dug up.

In terms of frequency of occupancy, or occupants throughout the night, in 24-hour gas stations we've assumed that six occupants pass through per night -- or per hour during the -- what we're calling the deep night, and 15 occupants per hour in the evenings and early mornings.

So, in the first part of the night, 7:00 p.m., 8:00 p.m., 9:00 p.m. we're assuming a much higher rate of traffic.

And that goes also in the morning, 5:00 a.m., 6:00 a.m.

But in the middle of the night, between 10:00 p.m. and 4:00 a.m. in that range a much slower rate of occupancy.

For facilities that are closed at night, we've just assumed one occupant per hour. And whether that's a night watchman patrolling the facility or a raccoon, it doesn't really matter. But it's just we wanted to have some conservative value in there that these

fixtures, you know, every so often might see some motion and get triggered.

The next slide. And so these are some of the savings results that we got when we modeled all of these scenarios. We think these are conservative.

From our own experience installing these types of controls in parking garages, parking lots you often see far higher kWh savings per facility, 10, 15, 20 thousand kWh, if not more.

But here, using the set of assumptions we put together, you see between 1,500 and 4,000 kWh, approximately.

The next slide. In terms of incremental cost, again we think we've gone with a fairly conservative estimate here. We've used $104 per fixture as the incremental cost. And that is based on manufacturer estimates for a fixture-integrated system.

For manufacturers that design using a zone system the cost per fixture are probably well below $105, they're probably in the $60 to $100 range.

So, again, not having data, measured data, we're trying to plug in conservative values and you can see how that plays out through all the prototypes there. the incremental cost ends up being about $3,700 in the larger canopies and, you know, $1,000 to $2,000 in the

other prototype spaces.

The next slide. And here are the results of the preliminary cost-effectiveness analysis. You can see a range there. There are some that are just over one in terms of the benefit cost ratio, and there are some well above one, above two even.

The next slide, so, just a summary of the results, the proposal was found to be cost effective using the assumptions that we plugged in, which we think are mostly conservative.

One thing that I didn't mention is that -- this was one of the more conservative things we did. We assumed that every time motion was detected in the space that all fixtures came to full brightness.

So, even if a car comes through a gas station that's got two canopies or, you know, two aisles, and that would really, likely only make half the fixtures come to full brightness, our analysis just assumed that they all did. So, that cuts into the savings.

The other thing, the prototype auto sales lot being very small definitely impacts the statewide savings potential that comes out of this analysis.

Anyone who's -- you know, you drive past the big auto sales lots on the highway, most of them are way bigger than what we've modeled here.

The next slide. So, this is a summary of the statewide savings estimates. Again, they're small here mostly because we're limited to the conservative cost-effectiveness analysis that we did, and then we just applied these to the State.

As we dig in more on this measure I think we'll want to, now that we've shown cost effectiveness for using more conservative numbers, we'll probably adjust some of those to be more representative type numbers.

So, these statewide numbers will likely increase. But, you know, the total right now is about 1.62 gigawatt hours.

In terms of comments that we've gotten so far, we held a meeting on May 15th and did get some comments that day. We'll go back to that slide, just back one. Forward one, yeah.

So, there were a lot of comments saying that LEDs are doing such a better job of dimming that maybe we should reconsider the --

(Technical conversation)

MR. MC GARAGHAN: That timer applied just to slide 22. We're too late in the day, okay, so I've got to move faster.

So, we did address that comment.

Another, there concerns that we might be

changing the 24-foot threshold for when motion-sensing controls are applied. We are not. The 24-foot threshold still applies and we are only touching outdoor sales lots and outdoor sales canopies, no other space type.

Another comment that was brought up is that the petroleum station industry and the car dealership industry, or those associations need to be contacted for input. And we've been trying. We have not gotten through. So, we definitely are aware we need to bring those folks in.

And as Jim just mentioned, they were here in the 2005 standards and they were very vocal. So, we want to make sure we engage with them and we're working on that, still.

I know there's possible concerns with marketing and there's possible concerns with safety.

In our experience with these types of projects, safety is not a concern that many customers -- the projects are being installed and customers seem happy with the results.

And from a safety perspective, the fact that lights ramp up when an occupant comes through is actually often perceived as a safety benefit.

Marketing is a different issue that, you know,

doesn’t apply to most of the space types that we’ve worked on in the past.

So, that may -- let’s see, is there another? Oh, there’s a slide, there’s another slide that shows some of the requests that we have, and some of the things that we’re just continuing to work on in terms of data collection.

The first and foremost there is measure data in nighttime occupancy trends in these space types.

So, if anybody has that, if you’re aware of facilities where these controls have been installed and have measured data that would be really helpful to the process.

We know of these types of projects being installed. There are some in California. We’ve heard numerous accounts of various sales lots and canopies where this has been installed, but we haven’t nailed down anything that we can go monitor, yet.

It sounds like this has also been done a fair amount around the Chicago area, and there’s been some projects in Texas, and there’s been some projects in the UK. But we need to find some that are close to home that we can go monitor.

Others include hours of operation in terms of the ratio of all-night or part-night gas stations.

Right now we're assuming about 65 percent are all night, which is based on our research.

Growth projections, helping identify potential monitoring sites, so if anybody knows somebody that would be willing to have their site monitored, we'd love to hear about it.

Percentage of auto sales lot poles that are under 24 feet. I think right now we assume 70 percent. I think it's probably more than that.

Percent of gas stations that have canopies and right now we're actually assuming a hundred percent because we had a hard time finding any that didn't have a canopy.

Additional cost data beyond the numbers we have so far, as I mentioned, safety and marketing issues we still want to explore. And all of these are summed up on the stakeholder website listed there.

So, I appreciate the input that I've gotten from a couple of you so far, and look forward to working more with various stakeholders to improve and make this proposal more robust.

But I think that covers it for today, so I'll turn it over for questions or input from the group.

MR. SHIRAKH: Any questions or comments from anyone in the room? Noah.

MR. HOROWITZ: Noah Horowitz, NRDC. I support the proposal and the research behind it. I think this is an exemption that isn't warranted and we should develop some sort of requirements along the lines you've proposed.

Two questions I have is a retrofit, do we have a sufficiently tight definition of a retrofit? So, often a gas station might be modernized or update. The canopy, itself, stays the same. They might adjust some of the lighting.

What triggers a retrofit? I don't know if you have an answer to that, but we should think about that. Do you want to answer that one or --

MR. MC GARAGHAN: It's something that we've thought a little bit about but, I agree, it needs probably additional clarification in the language in terms of when that is triggered.

MR. HOROWITZ: The second one would be we've got some gas stations who have got a big canopy, with several pumps on a little island, and then you have some that our outside of the canopy, when you're at a freeway interchange or something like that.

Is the lighting that goes over those islands that aren't part of the canopy covered and are they covered by our other outdoor lighting, and do these two

pieces work together?

MR. MC GARAGHAN: Good question. So, those would currently not be exempted from the controls requirements. So, they're already required to install these types of controls.

MR. HOROWITZ: Okay, thank you.

MR. SHIRAKH: Thank you.

Are there any other questions from the audience? Cheryl?

MS. ENGLISH: Cheryl English, Acuity Brands. Thank you. I also support the provisions that are being proposed. I think that there are clearly a lot of technologies available that can provide the occupant-sensitive lighting for the retail car lots, as well as the gas stations.

I have -- my company's expertise is not in the gas station area, but we have done the retail car lots. I'm trying to find some in California so that you can use that to try to do some measuring.

With regard to the gas stations, I did check the companies that often provide the products for those. They offer solutions that are occupant-sensing types of solutions, so I have to assume that those capabilities are already being sold.

I have one question on the dimming levels of the

occupancy sensing. I appreciate that you've modified that or suggested to modify it to 90 percent.

And I really question why there's any limit there. If the application warrants to have the lights turned completely off, I think that should be at the discretion of the designer and the owner.

If you equate it to what was being proposed for the indoor provisions, we realize some pretty significant gains by being able to turn the lighting in those day-lit areas completely off.

And I think the same potential's there for outdoor. So, I don't see any reason to limit it to the 90 percent.

I also look forward to working with you on the part-night definition because I do believe that it can be included in the automatic scheduling.

And that's my comments, thank you.

MR. SHIRAKH: Thank you, Cheryl.

MR. MC HUGH: I've got a question for Cheryl. So, Cheryl, you know, when I look at those, that definition of part-night control, it doesn't match my simple understanding of how they work. So, maybe you can help me understand this.

My understanding of how a part-night control works is that it essentially measures the time at which

is sunrise and sunset and it calculates, you know, what I'd call solar midnight.

And so it's -- what it's doing is it's constantly resetting itself based on, you know, when sunrise and sunset occurs. And you're able to then set things in terms of offsets from sunrise and sunset, and that's primarily how it works.

And when I look at the language that's given there, it looks like it's essentially -- it almost looks like a definition for a time clock.

So, it seems to me that the definition isn't really correct. You know, it's using time, but it's time relative to, you know, these measured events that require, basically, some type of photocell type input.

And I'd also like to just say that I agree with you that it seems to me that a part-night control could be used as a scheduling control, you know, for that part.

MS. ENGLISH: Yeah.

MR. MC HUGH: Actually, the scheduling control and also the part that says, you know, basically it's a replacement for an astronomical time clock where it's doing both the turning the lights off during the day, and also controlling lights according to a schedule.

MS. ENGLISH: Right. Michael and I spent some

time prior to the workshop talking about this and there are a variety of different part-night systems. The most simplistic does exactly what you said. It measures the amount of darkness and that calibrates every day.

And then the most simplistic version will, halfway through the night turn off.

There are more advanced systems so that you can use algorithms within that photo control to basically say I want the lights to not come on until 30 minutes after dusk. And then I want it at a certain percentage through the night to dim down to 50 percent. And then an hour before dawn to come back up to full light output for morning commute time.

And so those are, you know, more advanced. But they are essentially a time clock or an automatic scheduling. It's just that all the smarts are built within that photo control module and how sophisticated those algorithms are.

MR. MC HUGH: Thank you.

MR. SHIRAKH: Thank you, Cheryl.

MR. MUTMANSKY: Can I follow up with you on that because we talked about this back in 2008 and '09, when we were developing the most current one and even before that.

MS. ENGLISH: Yeah.

MR. MUTMANSKY: My understanding at the time was that these were, you know, a distributed intelligence system that was located in each head of the -- they were sort of geared towards retrofit situations and they were placed in the head of each parking lot pole, or whatever it was.

And, you know, essentially it's the set-it-and-forget-it kind of a system. And once they were running, they just did their thing on autopilot, you couldn't really override them, so the persistence was very good with them.

MS. ENGLISH: Yeah.

MR. MUTMANSKY: Are we still talking about that or have these things moved to essentially, you know, wireless controls and everything else such that we need to maybe just consider getting rid of the whole designation of part-night system entirely, and just put them into another category?

MS. ENGLISH: Yeah, I'm not sure I can completely answer the question. I believe that some of them can be controlled with wireless type of capabilities.

Some technology that's developed since we last talked about it is that it can integrate with the motion sensors.

So, during the early part of the evening the sensor is not going to override it terms of turning it completely off, so it will just stay on at, you know, the full light output up to a certain period of time.

And then after halfway through the night then it will allow the sensor to bring it back up.

But I do think it warrants more discussion about making sure that it can't -- that the definition doesn't allow it to be overridden to defeat the purposes of it.

And I was, at the May workshop, a little hesitant about the part-night control until after we talked more. And I think I don't care whether the words "part-night control" are in the code or not. I was just trying to make sure the definition is there.

And I think, actually, we can probably just get the definition in there where it would cover part-night as a technology that meets the requirements.

MR. MC GARAGHAN: And just to add onto that specifically, are we all on the same page that we could be updating the definition of automatic scheduling control to make sure that that is clear that it includes part-night, the capabilities provided by part-night control? Okay.

And then on your comment about the lowered dim range, I would defer to others in the room that were

involved in setting up that specific range. I don't see Gary Flamm anymore.

But my understanding is that that requirement was to ensure dimming capability rather than just an on/off capability so that -- to minimize the chances of somebody being frustrated by the controls and overriding them, and not utilizing them at all.

So, maybe there's a better way we can structure the requirement to ensure that it provides multi-level lighting, but also allow it to turn the lights off.

MS. ENGLISH: Yeah, I think that is one of the -- sorry, Cheryl English, Acuity Brands.

I think that is one of the concerns in the previous code. There was also some discussion about concerns on safety and security.

Again, I think because we're working on Title 24, which is an application standard, you could have a situation where your entire parking lot is going to go down to 20 or 10 percent, but you may have certain wall-mounted units that just don't need to be on unless somebody's there.

And I think that's my concern is that there are cost-effective solutions where the designer and the building owner know that certain products are going to dim down, certain are going to turn off, and it's

perfectly fine.

And right now the code doesn't allow someone to get that extra 10 percent savings.

MR. MC HUGH: So, I have a little bit of institutional memory left, I think.

My understanding of the purpose of not turning all the way off, in addition to the issues associated with dimming, had to do with the issue that it's actually used during periods that people are actually in the parking lot.

And the idea being that -- and this is based on a lot of work that CLTC has done, so it's unfortunate that Mike Siminovich isn't here to kind of explain sort of the -- some of the history.

But the idea is that this is sort of the third level of control. The first level of control was to turn the lights off during the day. It's kind of obvious and we've had that forever.

The second level of control was turning the lights all the way off outside of some period of which, you know, was considered outside of operating hours, et cetera, but also realizing that there are a number of people that don't turn off their lights at all during the nighttime because of concerns about liability.

But nonetheless, that if you had a store or

another place where actually there is a fair amount of activity at night that you didn't want to have a situation where these things were going all the way off and then, potentially, the control isn't used at all.

Now, I understand what you're saying is that, you know, we provide an opportunity for people to turn the lights all the way off.

And, you know, in fact with the discussion of part-night control there's also the opportunity to have, you know, different schedules so that actually after the normal operating hours the lights turn all the way off during the normal -- you know, so if you had a store that operated until 11:00 or something, maybe starting at midnight those things go all the way off when there's no activity sensed.

But the primary basis of that standard of having some light during the time was to actually make sure those people would actually use it during occupied periods.

And so, you know, maybe there's a halfway point which says something about if you do want to turn the lights all the way off that you have that capability, but you also have the capability to have it -- to leaving the light on to some intermediate level so that you are obtaining all of that benefit that occurs during

the occupied periods. Thank you.

MR. MUTMANSKY: That's correct, Jon. I mean, basically, the history is pretty much exactly as you recall, so your memory is not too far off, anyway.

But we -- I think the other thing here to remember is this was -- these things were all built at a time when control systems were discretely doing one thing.

And again, just as we talked about earlier with the other controls, they're now doing everything for us, one system is now doing -- can do the scheduling, it can do the -- you know, the occupancy sensor high/low approach, and then it can do the afterhours off and on approach, and it can do the works.

So, I think we need to be thinking about revising these things to not limit people in that way and still give -- you know, have that capability in the system.

MR. SHIRAKH: Okay, any other comments?

Sir?

MR. JOUANEH: Just very briefly, Michael Jouaneh, Lutron.

Is sales frontage already defined in the standard?

MR. SHIRAKH: Yes.

MR. SHIRAKH: Yes.

MR. MC HUGH: Yeah.

MR. JOUANEH: Okay, I just want to be sure that there's a clear definition of sales frontage versus sales lot, versus sales canopy.

MR. MC HUGH: There's different LPAs, et cetera, so it's --

MR. SHIRAKH: Yeah, they're defined.

MR. MC GARAGHAN: It's a good question though because by my read of the definition it probably could be more clear.

The definition basically says, you know, the portion of the sales lot that is adjacent to the street or the front of the property.

And I don't believe it has any distance --

MR. MC HUGH: I think it does have distance. You might want to check that.

MR. SHIRAKH: It does have some criterias, I think it's like two car lengths or something. Oh, he's looking it up.

MR. MC GARAGHAN: Anyway, it's a good point and we should look -- we'll make a note to look into that further.

MR. JOUANEH: Okay, thank you.

MR. SHIRAKH: Any other questions on this topic?

Anything online?

MR. OWNBY: No, nothing online.

MR. SHIRAKH: Any other -- now, we're into public comments. Any others?

MS. RAINER: Rebecca Rainer, Eaton Cooper. I just want to reemphasize a comment that Cheryl made. We've got a lot of great information today. It's certainly been a lot of hard work, we can tell.

I, for one, incorrectly assumed that the new baseline was based on LED technology of today, not 2017. So, while I'm not saying that I disagree with that concept, I am very anxious to review the models and really get to look at those, and evaluate those.

With that being said, July 11th is two weeks from Thursday --

MR. SHIRAKH: All right, so --

MS. RAINER: -- with a holiday in between. So, I would ask you to please reconsider that date and consider extending that date.

MR. SHIRAKH: How about July 25th?

MS. RAINER: July 25th is much better for me.

MR. SHIRAKH: Friday. For comment deadline, yeah.

Yeah, so I mean those of you who work with the Commission, you know the comments, whenever they come in

are considered.

But this allows us to schedule, you know, our summer into August, you know, because we have to get these comments, incorporate them, then start drafting the standards based on those comments.

So, it does impact the work that we're doing in August and September. So, the sooner you can give them to us, the better.

So, if there are no other comments, I appreciate it. It's a long day.

Sir, go ahead.

MR. HARING: Just a few more general comments. So, Rick Haring, Philips Lighting.

Just we're seeking, as the rulemaking goes forward, we're seeking to perhaps have better clarification on demand response requirements. We're saying that perhaps the way the demand response section is written could be greater clarified.

The language is confusing and provides little guidance for compliance methodologies.

The compliance manual, the latest revision changed the intent of the code from 15 percent reduction from total installed lighting power to 15 percent reduction from current power level.

In other words, originally the code implied that

the reduction was from the total maximum load, but was modified later to require the reduction from wherever the power is at the time of the demand response event.

Furthermore, the code requires that a DR-controlled power calculation be made and excludes counting areas with LPDs of less than .5 watts per square foot.

This essentially lowers the total load required to be controlled using demand response. However, demand response measurement is typically taken at the main distribution panel, which is measuring the total building electrical load, itself.

We're also seeking to provide or have a proposal to exclude designs that are at .5 watts per square foot for all control requirements, except auto off, local control and daylighting controls.

And we seek further clarification to have or to provide clarification on alterations versus luminaire modifications in place.

It's very difficult to describe the difference between the two and in a lot of cases words are used almost interchangeably with retrofit.

Since the core requirements are the same, just have the same set of requirements for both.

Thank you.

MR. SHIRAKH: Thank you.

Any other comments?

So, with that I'll close the workshop. It was a lot of information. You know, we're going to be considering all this. The transcripts of this workshop will be available in, I don't know, ten days or so and you'll be posted online, for the website for this workshop. Thank you.

MR. MC HUGH: Mazi, was there anyone online who had questions?

MR. SHIRAKH: I asked and they said no.

MR. MC HUGH: Oh, okay.

MR. OWNBY: That was for the last presentation. Here, let me see. Nope, no one has raised their hand.

MR. SHIRAKH: Thank you.

(Thereupon, the Workshop was adjourned at 4:40 p.m.)

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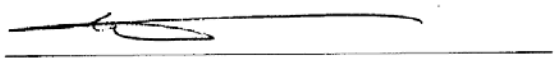

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