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BEFORE THE

CALIFORNIA ENERGY COMMISSION

In the Matter of:	)	Docket No. 14-AAER-2
	)	
2015 Appliance Efficiency	)	
Pre-Rulemaking California	)	
Code of Regulations, Title 20	)	
Sections 1601 through 1608	)	Staff Workshop

Staff Workshop on
Computers, Computer Monitors, Signage
Display Efficiency Opportunities

CALIFORNIA ENERGY COMMISSION
1516 NINTH STREET
ART ROSENFELD HEARING ROOM
SACRAMENTO, CALIFORNIA

WEDNESDAY, APRIL 15, 2015
10:05 A.M.

Reported by:
Peter Petty

APPEARANCES

Commissioners Present

Andrew McAllister

Staff Present

Ken Rider
Harinder Singh
Pat Saxton, Advisor to Commissioner McAllister

Also Present (* via telephone)

Stakeholder Presentations

Chris Hankin, Information Technology Industry Council
Mark Hollenbeck, Hewlett Packard
Shahid Sheikh, Intel
Gary Verdun, Dell
Donna Sadowy, Advanced Micro Devices
Mark Cooper, Consumer Federation of America
Bach Tsan, California Investor Owned Utilities
Nate DeWard, Energy Solutions
Peter May-Ostendorp, Xergy
Pierre Delforge, Natural Resources Defense Council
Vojin Zivojnovic, Aggios
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Public Comment

Gary Fernstrom, PG&E
Ned Finkle, NVIDIA
Stephen Eastman, Intel
Charles Kim, Southern California Edison
Andrew deLaski, Appliance Standards Awareness Project

I N D E X

P R O C E E D I N G S

APRIL 15, 2015 10:05 A.M.

MR. RIDER: We'll go over some housekeeping here and then we'll move on to some opening remarks from Commissioner McAllister.

Good morning, everyone. I'm Ken Rider, and I want to go over a few housekeeping items before we begin.

For those of you that are not familiar with this building, the closest restrooms are located out that door to the back.

There's a snack bar on the second floor, under the white awning, and that's just above the staircase out the door.

Lastly, in the event of an emergency and if the building is evacuated, please follow our employees, like me, to the appropriate exits and we will reconvene at Roosevelt Park, which is located diagonally across the street from the building. So it would be out the door and to the right. And then please proceed calmly and quickly following the employees with whom you are meeting to safely exit the building.

Thank you.

LEAD COMMISSIONER MCALLISTER: Okay.

Well, thanks everybody for coming. I'm Andrew McAllister, Lead Commissioner on Energy Efficiency here at the Energy Commission. It's great to see the turnout today. I'm really excited to hear what the conversation -- how it goes and really encourage you all to participate fully.

You know, over the last 18 months or so, we've really tried in this area of device -- of devices and all the others that are at various stages of development in terms of developing Title 20 Appliance Efficiency Standards, and we've really tried to create opportunity after opportunity consistently for folks from all the stakeholder groups, you know, industry and advocates and everyone working in these issues to provide their input. You know, more information is better. But it's a voluntary process, and our decisions depend on having a record that is robust. And there's every opportunity in the world to -- for folks who have informed opinions to put that on the record so that we can take it into account for development of the standards.

So this computers and monitors and all the categories that are under discussion today for this group of devices, we're in the pre-rulemaking phase. There's a staff report out, and we have not opened the formal rulemaking, so we're in a relatively free-form period. But there's a good proposal on the table that we really want to get everyone's feedback on.

We're focused on waste, on relatively easy opportunities for reducing waste in computer servers, monitors, and displays. Generally, the focus is on standby, and there's lots of ways that staff has identified and we're looking forward to hearing everyone's opinion about that, for reducing that waste cost effectively.

Let's see. I want to point out Pat Saxton here, who is my adviser on this issue. And he or my other advisor here, Hazel Miranda will be in the room most of the day. I'm going to have to come and go a little bit. This is a staff workshop, and I'm going to leave it to Ken and the crew to keep things moving forward and make sure everybody gets their voices heard, and orchestrate the proceedings.

But I want to just thank, again, all of you for coming, thank staff for putting it together, and keeping the train moving down the tracks here. And we're looking forward to hearing everyone's participation.

So thanks very much. Back to Ken.

MR. RIDER: Thank you, Commissioner.

I just want to briefly go over the agenda. We've got a very full agenda today. We're going to go through staff presentations and then industry presentations and then we'll move on to public comments.

I want to highlight, if you know that you're going to make -- or you're certain that you would like to make a comment in the open discussion and comment period, it would be very helpful if you fill out a blue card and I'll take the blue cards first when we get to the open comment period. The gentleman in the back of the room at the table there will collect the blue cards and hand them to me, and when we get to the open comment period, I'll read those off first and then I'll go generally to the room after that.

So I just want to be kind of clear on the process for today.

LEAD COMMISSIONER MCALLISTER: Actually,

Ken, I'm going to jump in and just say one other thing.

MR. RIDER: Yes.

LEAD COMMISSIONER MCALLISTER: I just want to make sure -- I often forget to do this, and I'm just going to correct myself here at the outset. You know, we, California, has adopted long-term goals for carbon emissions, and a fundamental part of that strategy has to do with energy efficiency. So I just wanted to highlight kind of the importance and the broader context of what we're doing here today just to put a finer point on it.

You know, energy efficiency still remains a huge opportunity to reduce the impact of our energy systems in California. Lately, we've been working more in the water arena as well. We're in a state of emergency, and we have an Executive Order that really asks us to double down on that area.

But this set of devices, certainly, computers, you know, are a big deal in California. We all know that. And they present -- they have a lot of energy consumption, and they present good opportunities for savings.

So this is part of a long-term strategy for the state to reduce its carbon emissions, primarily within that energy efficiency. And that's why it's important, and that's why we want to make sure to consider all cost-effective opportunities and really understand them so we can inform our decision and come down in the right place on this. So we really depend on all of you to participate fully in that process. It's important and it's urgent.

So thanks again.

MR. RIDER: Thanks.

So my name is Ken Rider. I'm an electrical engineer. I'm the lead on the computer standards.

Today's agenda for the presentation that I'm about to give, I'll go into some background about computers, go into the energy use, some of the efficiency trends, then into the actual proposed regulations, explain exactly what's being proposed in the staff report, go into some of the benefits, like energy savings, and then kind of go over the timeline and next steps for the process.

So, as Commissioner McAllister mentioned, we've been at this particular topic for quite some time. We've provided many opportunities for public input. We first decided to look at computers way back in 2011 and going into 2012. And during much of 2013 and '14, we were gathering data and information and comments.

The proposed computer standards are focused on four main form factors, which are desktops, notebooks, small-scale servers, and workstations. And in the proposed regulations, thin clients and integrated desktops are combined into the desktop category.

So computer use over the years has increased quite a bit. When I was born in 1984, 8.2 percent of households had a computer. And you can see, only recently have we started to reach the plateau of saturation, according to the U.S. Census data.

Desktops still make up the majority of primary computers in residential spaces, according to the most recent home surveys conducted here in the State of California, and notebooks are a huge chunk of that, too. So you can see, essentially, it's almost a 50/50 split between desktops and laptops in terms of the most used computer in households today.

So this is really important terminology to understand. I'm sure it's going to come up, these terms, several times throughout the day. Computers operate in several modes; and, today, we're really going to define them into five discrete modes.

Off mode, which is where the computer is -- it's also referenced as "soft off," is where the computer is, essentially, shut down but not by a hard switch; it's just if you hit "start," "shut down," on a Windows machine, that would be off.

Sleep mode, it can be entered either manually or automatically, but that's where the monitor is off, the computer is really in a very low power state and you can't -- it's not really actively doing anything.

Short idle and long idle, these are where the computer isn't being used. And, for short idle, it's roughly five minutes of inactivity, computer, no programs are running; it's just sitting there and no one is using it. Long idle is a bit later on, the screen's shut off, still no one's been using it, and it's just --

essentially, it's been running idle for a longer period of time.

And then there's active mode, which really isn't the focus of today, but active mode is where someone is currently using it. I'm -- this computer I'm on right now is in active mode.

And each of these modes is progressively higher and higher power.

Idle modes are very important because computers spend a significant amount of time in idle modes. For example, the Energy Star duty cycle assumes that conventional desktops are on in idle for 50 percent of the time and 40 percent of the time for notebooks.

And the energy consumption in other modes, such as, sleep and off, are fairly minimal, and I'll give an example of that. Here's a desktop. So if you take a regular desktop computer that -- or a typical one that has a long idle of 45 watts, a short idle of 50 watts, sleep at 2, and off of 1 watt, that's really kind of run-of-the-mill numbers, you can see what that translates, given the duty cycle, into energy consumption. Between short idle and long idle, you've got 98 percent of the power consumption in a desktop. So that's why you see a lot of focus and discussion in this presentation and probably other presentations on short and long idle.

Computers also make up a fairly significant amount of statewide electricity use. Staff reviewed the studies that were submitted as part of our data-gathering process, and those studies showed between 2.5 and 4.4 percent of residential electricity consumption is in the computer itself. That's not including computer monitors or any accessories.

The computer consumption in commercial spaces is also significant, particularly in offices and educational spaces where, in buildings of those types, computers can make up over 10 percent of a building's electricity use.

And the majority of this computer electricity consumption is in desktops. Even though some studies show that desktops make up the minority of actual units, they use -- their power consumption levels are so much higher than laptops that they make up the majority of energy use.

The good news is the industry is making a lot of good progress towards lower-consumption computers. And, even better, the parts and progress are cost effective. They run very fast, and the energy efficiency improvements are very impressive.

Innovations in laptops have led to power-consumption levels that are three to four times less than those that are commonly found in desktops. And, also, desktops are increasingly incorporating low-power idle states and low-power idle components and protocols that are enabling them to reach some of the same levels of power consumption.

And then sleep mode has already been -- I mean, industry has done a great job on sleep mode. It's been at low power for quite some time.

I'm going to kind of go part by part, the components that are -- and this is mostly a desktop focus -- just some of the energy efficiency improvements and opportunities that are out there.

So beginning with power supplies. Back in 2005, the 80 PLUS program got kicked off. It's run by Ecova's Plug Load Solutions. And it's led to market transparency and also the identification of efficiency in power supplies. And it mainly focuses on 100-percent, 50-percent, and 20-percent output efficiencies.

The first product was certified in 2005, and today there are over 5,000 certified models. So it's really taken off since its induction. And there's been large momentum in both the Bronze, which is better than minimum, and Gold, which is -- quite efficient power supplies. And the price has been going down for both those categories as a result.

In addition, the U.S. DOE has adopted new requirements for external power supplies that will increase the minimum efficiency for external power supplies. That's important to laptops, as that's the primary way those get powered. And they've also reduced the no-load losses of external power supplies to a maximum of .2 watts. And so those requirements are coming down the road in February of 2016.

So this slide demonstrates the importance of efficiency in the power supply, and also, really, the importance of efficiency to idle mode power consumption. So the idle mode power levels proposed in the standards are below 20 percent of most of the nameplate outputs of the power supplies on the market today. And the 80 PLUS doesn't really focus on that, but you can see that, you know, if you have a 60-percent efficient -- so these are the efficiencies of the power supply at idle mode. In an idle mode situation where the power supply -- and this is pretty obvious -- if it's 60-percent efficient, you've got 40 percent of the losses in the power supply unit and 60 percent getting delivered to the computer.

If, at the low idle mode power loading point on the power supply, you get 70-percent efficiency, now you've got a savings of 14 percent. And the PSU is starting to not become the dominant idle mode consumption. If you can get to 80 percent, then really the PSU is starting to become a fraction of the power consumption that's contributing to idle. So efficiency at low power loading levels is pretty important in terms of hitting low idle power targets.

There has been a lot of innovation in processor efficiency. New processors are more efficient per executed instruction, so in active mode, they're far more efficient per instruction then they have ever been. And they're also scalable, which means that they -- newer generations of processors are much better at matching their power consumption to the workload that they are requested to do.

The introduction of lower power working states, also known as C-states, are implementing CPUs that allow them to be progressively less consumptive the more idle a computer becomes, and those are not even just package-wide, those are core specific. So with the introduction of multi-core processors, the C-states allows individual cores that are idle to even enter these states. These low power states allow processors to scale and reach consumption levels of 1 watt when completely idle. And, also, processor manufacturers and computer manufacturers have introduced new sleep states, sleeplike states I should say, they're still active modes, such as SOI 1 and SOI 3, which are kind of connected standby modes that really allow computers to enter very low amounts of power with very high latency in waking up.

Hard drives, the data that we've seen on hard drives show a wide variation of power consumption in idle mode, anywhere from 0.05 watts for, you know, some of the best solid-state drives to 7 watts in idle.

The good news is that improvements to SATA standard, which is the, you know, most commonly used communication protocol for internal storage drives, is including more and more power management states with the newer versions. I think the latest version is 3.2. And these new power management features allow for, not only lower power modes in the storage devices, but also in the controller itself. So the controller that manages the hard drive is also able to go to sleep with the latest SATA protocols.

And there's even the introduction of even deeper sleep modes, such as device sleep, and those allow for idle power draws in the milliwatts, so like 5, 6 milliwatts, which is really impressive.

There's power reduction opportunities in memory, lower voltage memory just inherently consumes less power. Memory is somewhat transitioning to DDR4, which is -- that standard of memory just has a lower voltage supply compared to DDR3, which is maybe the most common current form of memory. Also, advanced management of memory can allow for power reductions. So there's some really clever ways that some manufacturers -- in memory, manufacturers have used to reduce power consumption by consolidating used data and specific modules and putting other modules to sleep.

And idle state can be entered, similar to the sleep state of RAM, when processes have reached minimal amounts, when workload is very low.

There are a lot of opportunities in motherboards as well. Motherboards contain a vast array of controllers, chips, and voltage regulators, and so there's a lot of parts there that can be improved upon. And some of the best motherboard manufacturers are certainly making progress on that. Desktop motherboards, particularly, often have controllers and devices that are never in use, or not currently in use, because of their large number of expansion slots. And you can see in the little picture here, all these little slots, you know, some of them typically are filled, but a lot of them aren't. And so some motherboards allow for power management of those slots, where if they're not used, then the controllers are put to sleep right out the gate to save some power.

There's been some interesting innovations in optical drives as well. I mentioned already that SATA has updated many of their power management protocols, but an interesting part of those new protocols is something called "zero-power optical drive." And, essentially, CD drives that are not in use are able to go to zero power consumption, essentially, shut off completely, when there is nothing going on. And then when the tray button is hit, it wakes up and it goes to being fully active again. So some significant power-saving opportunities there.

So cooling. Cooling has been necessary even in idle when the idle power has been fairly high. So when you get an idle power that's in 50 or 70 watts, that's still enough power where you need to run fans to keep the components cool. And if the CPU and other components aren't able to go into idle mode, then these fans need to continue running to keep the chips and parts from overheating. However, when low power -- when idle is -- when very low-power idle modes are achieved, a lot of the cooling can be shut as well by either completely shutting down case fans and cooling fans on CPU or at least reducing the RPM, the rate of rotation, and, therefore, saving some power.

Graphics cards have made great leaps in terms of idle mode power. Some of the fastest and best graphics cards on the market today also are ones that use some of the lowest idle mode power. We were talking earlier about the GeForce GTX. We've got some NVIDIA guys here. That new card, I've seen some numbers on the Internet, has the lowest idle power I've seen out of various graphics cards I've seen. We haven't done the testing yet, but the numbers I've seen on the Internet are pretty impressive. So these guys are really doing some great work on bringing down their idle mode.

In terms of the short-idle mode versus the long-idle mode, so something to call back to what I was saying about modes, the long-idle mode, the screen is off, so in terms of achieving really low RMO powers, the graphics card workload is in the absolute minimum mode it could ever be in a long-idle situation where the screen is off and, you know, no programs are running. So that's something to consider, if there's an opportunity to even further lower graphics cards' power consumption. Some machines are using graphic switching, mainly in laptop computers, to achieve some of that lower power consumption. And also mobile graphics cards are achieving some pretty low idle consumptions.

So this is a chart, a breakdown, of the power consumption of different components. This was provided by ITI in its comments to the Commission. And what I did is, I took a look at this from the perspective of a 50 watt idle desktop computer. And you can kind of see, this scales pretty well with what we've seen in measurements in terms of power draw per component. And what I did is, I took a look at this and I considered, okay, with all these technologies mentioned before, where would this be heading with, you know, the scalable processors, with the zero-power optical drive, if you hit the low idle modes, reducing the fan speeds, doing all that kind of -- incorporating all the great innovations the industry has produced over the last couple years. And you can really drill it down.

Like I said before, you know, the idle mode on the CPUs can reach levels around 1 watt. Those are measured on current CPUs. The optical drive can hit zero. I gave a little bit of a budget there. But you can really see that the new technologies really, really allow the shedding of a great amount of that idle mode power, and that's what leads to this low-power idle target of something around the order of 12.2 watts.

The proposed standards is in terms of annual energy consumption per year, it allows tradeoffs, but this kind of gives you an idea of where staff is looking at in terms of transitioning from kind of current levels of idle, or maybe this even a little bit year-ago kind of levels of idle, to what one might expect going into the future.

We took a look at all the proposals submitted by stakeholders. We also investigated standards from all over the world. So we looked at the US Environmental Protection Agency, the Energy Star program, we looked at China, we looked at the European Union's computer standards, and we also looked at Australia. And we took a look at all the standards that are in the world and all the things submitted by stakeholders, and we tried to come up with draft standards that would maximize the energy savings, harmonize as much as possible with existing standards, and also incorporate all the comments and feedback that are in the record.

And so we came up with the regulations you saw in the staff report. And I'm going to go ahead and go over exactly what we're proposing.

So the scope of products in the staff report includes desktop computers, notebooks, small-scale servers, workstations, thin clients. Some things that it doesn't include are tablets and game consoles, handheld gaming devices, like the PSP, servers, like full-scale servers, and industrial process controllers, computers that are really used in like factory-type settings. And, you know, there's a whole lot of other things that are not in the scope, too, that are -- but these are some of the biggest ones we got asked questions about.

The definitions in the proposed standards are taken from Energy Star Version 6.1. Those definitions go into a little more detail about what a notebook is, what a desktop is. We had to make some small modifications to the language and definitions to reduce it to necessities. There was a lot of extra language in there, helpful Energy Star guidance language, that just doesn't fit in a regulatory setting.

For the test procedure, we are proposing to align with Energy Star Version 6.1, and the proposed regulations quote the August 2014 version of the test procedure. And we also propose to use that specification, that test procedure, for calculating energy -- annual energy use.

So the requirements for computers can be broken into kind of two segments.

We have some power management requirements. Computers that would be sold or offered for sale in the State of California would need to put displays into sleep mode after 15 minutes or less of user activity. I believe that's aligned with Energy Star. All computers would be required to transition into a sleep mode after 30 minutes or less of inactivity, with the exception of small-scale servers, which would not be required to transition into a sleep mode. Small-scale servers and workstations must be manufactured or sold with an 80 PLUS Gold Level Power Supply and also have energy-efficient Ethernet cards or features. And then notebooks, desktops, and thin clients -- and, again, thin clients having to meet the same standards as desktops -- must meet certain energy consumption targets. So the targets are contained in this table, as well as some proposed implementation dates.

So the target for notebooks is 30 kilowatt hours per year, plus some adders, and I'll get into what those matters are in the next slide. And then the target for desktops is 50 kilowatt hours per year plus some adders. And there are -- you night notice that there aren't any sub-product classes, like Energy Star breaks down and some other jurisdictions break down these products in many subcategories. The staff proposed regulations do not do that.

The effective dates -- and this is just

thinking of when we would think this would be effective -- would be January 1, 2017, for notebooks and small-scale servers and for the workstations. And, then, January 1, 2018, for desktops. And, again, that includes thin clients.

The proposed adders, many of you might be familiar with these, these are the same as Energy Star 6.1. There are adders for memory, so the more capacity of memory you have, the more annual energy use you are allowed to have. There is an incentive adder for energy efficient Ethernet for desktops and notebooks. There's a storage adder. And just to be clear by the storage adder, that's for every additional -- just like in Energy Star, it's for every hard drive or disk drive -- excuse me -- in addition to the first. So if you have a second hard drive, a third hard drive, you get to add this for every additional one. And then there's an adder for integrated display. For a laptop, that would be an adder to compensate for the screen that's built into the laptop. And then for a desktop, there are some desktops where the screen and the computer are all one, they even call them all-in-ones, and there's an adder to allow for more energy because of the screen's use.

In addition, manufacturers would be required to certify their compliance with the standards in order to be able to be sold in this state. The amount of data we would collect is the minimum amount to determine whether the product complies, so things like the annual energy consumption, so we can check the annual energy consumption, the amount of memory, things that are very similar to what Energy Star collects for their certification.

Staff does not propose any specific labeling or marking requirements. The manufacturer name and model number would be required to be on the product just so that we can verify that it's in the database, but there's no additional special mark or any type of thing that we're proposing along those lines.

So with the proposed standards, we estimated what the energy savings could be. And I just wanted to kind of go over what our methodology is. So we have a data set of energy consumption of computers that are sold today in the market. And what we did is, if a computer already met the standards, like this one, the green dot here, then we kept the energy consumption in that computer the same. It doesn't change. So we didn't assume any improvements to efficiency. But if the product was not compliant, like this blue dot, with the proposed standard, to calculate the energy savings, we went ahead and moved the dot to exactly compliant with the requirements. So we didn't take any -- it's kind of a conservative approach. We didn't assume that they would go beyond or do anything other than exactly meet the requirement. And so the energy savings that we calculated were coming out of these blue dots that we're moving down to the line and it was status quo for products that already met the standards. And what we did is, we calculated the average energy use kind of before and after these modifications were made.

For workstations and small-scale servers, we took a little bit of a different approach. We assumed that the workstations and small-scale servers are using kind of 80 PLUS baseline power supplies, and then we calculated the energy savings of moving that power supply from baseline to Gold Level, and then we took the wattages that are reported in databases, such, as Energy Star and modified them by the percent-efficiency improvement from going to the Gold Power Supply.

So, for example, a workstation that may have reported an idle power of 180 watts, and then using a baseline power supply, would be adjusted to 165.5 watts by doing, you know, this calculation. So the basic 80 PLUS level is 80-percent efficiency and then Gold is 87. So that's how we kind of converted the wattages of today's workstations to what they might be as a result of the standard.

So the results are summarized here in the table. We have the average energy use of a baseline computer, one -- and so those would be the dots that didn't meet the standard at the outset, and then the average use after they were moved to meet the standard. And we did lifecycle cost analysis and came up with $69 of savings for desktops, $2.30 for notebooks, small-scale servers we found a lifecycle cost savings of $19.20, for workstations $29.92.

So per unit, you can see that workstations -- per unit, you can see that basically desktops have the largest incremental improvement. And then we also took a look at incremental costs, and the staff report goes into this as well. Those incremental costs are estimated here. The $13 incremental cost estimates for small-scale servers and workstations mostly relates around the incremental costs from improving the power supply, and then for desktops and notebooks, these incremental costs are primarily focused on engineering and not part improvements.

In terms of statewide energy savings that could be reaped from the standard, again, desktops, by far, are the largest excepted energy savings from the proposed standards. The total is also fairly significant, 2,117.2 gigawatt hours per year. So there's a lot of energy savings to be gained from improving the annual energy consumption of computers.

In addition, all those energy savings translate to millions of dollars of savings to California businesses and consumers. 2,117 gigawatt hours per year translates to $339.9 million per year in reduced electricity costs.

Also reducing electricity consumption is to lower greenhouse gas emissions because of reduced demand in power plants. And staff has estimated that the annual emissions will be reduced by a little bit over a half a million metric tons of CO_2 equivalent per year.

So staff released this draft proposal. We're in a comment period right now. Those comments are due on May 15th. And once we receive those comments, we'll take them, we'll look at the issues, compare them to what our proposed standards are, and try to figure out the best pathway forward. We have a new eDocketing system. For those of you who submitted a presentation, you got a taste of what that system is. It's very easy to use. There's a link right here. It's on our rulemaking page, and, essentially, allows you to upload directly through the webpage your comments. And I believe it gives you feedback when those comments have been posted. It also directly posts those to the website, so it's a much faster and more convenient way than we've been previously doing in this process, in this proceeding.

You can also send your comments in by

mail. The address is here. I won't read it out loud, but the address is on the notice and it's also on our website. You can send it to the -- just remember to include the docket number, which is, for this proceeding, 14-AAER-2. And we look forward to hearing your comments, and we will be working hard to incorporate your feedback into the next draft version of the standards.

So we're not going to go directly into open comments just yet because we have so many presentations to go through. So we're going to translate -- or transition to doing the stakeholder presentations. Save your questions on this presentation and any of these other presentations until we get through all those, and then we will have an opportunity then to revisit some of these items if you have any questions on this presentation.

So, with that, I'm going to move on to -- I believe, Chris, you're up first. And then let's see here. Yeah, so you're just going to want to --

MR. RIDER: Want to use page down and page up here to get through them? These two here?

MR. HANKIN: So to move forward --

MR. RIDER: Yeah, page down to advance forward and page up to go back.

MR. HANKIN: Cool.

MR. RIDER: And if you have any problems, I'll hop back up here.

MR. HANKIN: This isn't me. Got it. I got it. Sorry. Sorry about that.

MR. HANKIN: Thank you.

Mr. Commissioner, thank you for holding this event.

I will be the first of five speakers on behalf of ITI and TechNet. I will be probably the briefest. I'll certainly be the least technical.

The great privilege that I've had since I joined ITI five years ago is to represent the most innovative companies in the world. The most -- the companies who are leading globally on energy productivity. The companies that, as ACEEE put it back in 2008 -- I'm going to actually read the quote, "Information and communication technologies have transformed our economy and our lives, but they have also revolutionized the relationship between economic production and economic..." I'm sorry "...and energy production." That's a revolution that has continued since 2008. It will continue. It will probably accelerate as the Internet of Things enters into our lives. But it's not just what we're doing to the -- this revolution on the economy and the relationship to energy production, but it's also the performance and productivity of the products themselves. And this is a slide from Skip Laitner with ACEEE that he produced back in 2011. I hope you can read that bottom number, that represents our industry, it's a lot bigger than the other ones. I'm not sure where government would fit on here, but it's certainly our intent to help governments do better on their energy productivity. In fact, that's something we're trying to do for all our customers.

Our companies compete very vigorously on the performance of their products, the price of their products, and the energy efficiency of their products. I think -- this includes a partnership we've had with the U.S. Government, more specific, the USEPA, on the Energy Star program for over 20 years. It also includes partnerships we've had with other governments globally. We would hope we can proceed in a similar spirit of cooperation and partnership with the California Energy Commission.

I noticed in one of the presentations that will follow the industry presentations, there was reference to market failures and an implication that our industry does not have a motivation to produce products that are energy efficient. That's an interesting comment. It's one actually that we looked at as an industry, with U.S. DOE and USEPA back in the early 1990s, how to create more of a market driver behind energy efficiency, and that's why Energy Star was created for our products. We were the original -- we were original partners in Energy Star. Actually, last week, we found an old Roll Call ad that we paid for back in, I think it was '93, with the start of Energy -- celebrating the start of Energy Star and this mutual effort between the U.S. Government and our industry to help drive energy efficiency in our products. I just want to make very clear that this is a longstanding commitment of our industry.

Now, on to the proposal before us. ITI

and TechNet have very serious concerns with the staff draft proposals. If promulgated, we fear they would risk doing damage to productivity and capabilities that we can offer our customers in California. This would include, not only all the consumers in California, but even more so, our corporate customers and especially those who demand high-end computers.

As the Commissioner said though in his opening comments, we're not in formal rulemaking, we're still in pre-rulemaking. There's time to try to address our concerns. We're committed to working with the CEC and other stakeholders on finding solutions. We can get this right. It isn't right right now.

The speakers who follow me will go into much deeper dives, but what you'll see in those is there's a deep disagreement right now between ourselves and CEC staff and other stakeholders on the data and the data analysis behind the -- especially behind the technical feasibility and cost effectiveness of the proposals.

It's hard for us to see how we move forward constructively together unless those deep disagreements and divisions are addressed. And so an offer that we make here today to discuss this with some of the representatives of the IOUs, is we would like to host a full-day meeting at an appropriate time -- we're thinking right now late May, early June -- and really do a deep dive into the data, the data analysis, and see if we can't address some of these divisions and find a good basis on which to move forward on our shared objective, which is a rulemaking in this space that is good for California.

As a side note, I also want to add, back in last year, we not only submitted proposals on computers and displays, we also submitted a supplemental proposal on intelligent efficiency. This is a quote from an ACEEE report from back in 2013 as to the benefits that they see looming, I'd say the opportunities, that are there for us if we take advantage of intelligent efficiency. "We look forward to working with the California Energy Commission, other parts of the California Government, and other stakeholders on seeing if there aren't ways that we can work together in a nonregulatory manner as partners to promote and accelerate the benefits of intelligent efficiency."

Thank you.

MR. RIDER: All right. Next speaker, I think that's Mark; is that right? Yeah. Okay.

MR. HOLLENBECK: Thanks.

MR. RIDER: Page down to go through your report.

MR. HOLLENBECK: Oh, excellent. Thank you.

Hello. My name is Mark Hollenbeck. I'm with Hewlett Packard and am here representing industry. And I'm going to talk a little bit about the computer proposal and focus, following Chris' comments, on the customers that we provide these products to, the framework of the proposal, and the impacts of what we're seeing in the current draft of the regulations.

And this basically just covers the points that I'm going to cover. And I'm going to go ahead and move ahead. And I'm going to skip slides. I'll come back to that one in a minute.

As Chris was talking about, customers, we felt that that's the right place to start the discussion because there are a wide range of products that this industry serves with computers, and a lot of -- a range in the types of customers that use them and the performance that we offer to customers.

Customer use profiles are one way to look at the products that we're offering to the market. And so if you look at the use profile starting at the left here, you would start with basic home users. These types of products and these customers are doing very basic things. They're accessing the Internet. They're doing basic productivity activities, which include drafting documents, writing e-mails, et cetera. But they don't require a computer with a lot of performance. And the cost is commensurate with that as well.

So, then, looking at another range of customers, you have customers that fit into both a mid-level office user and a home user. These customers are doing the same types of things that the basic users are doing, but they're doing additional things as well. They're sharing pictures, viewing movies, using basic productivity software and collaboration.

And then another higher level of both home and office users that are doing all of the basic user -type things, but they're doing some significantly different activities in productivity. So they're not only viewing pictures and movies, but they're actually modifying them. And this requires more graphics computing power. They're using the basic productivity software, but they're also doing much more sophisticated activities as well, and that would be scientific and financial analysis, some modeling as well. All of that demands more computing power.

And then on the extreme upper right, you've got your extreme users. These are primary home users. They are primarily doing gaming activities. This is a market that is served mainly by advanced desktop computers.

Okay. So now I'm going to talk about the products that we offer to serve the broad range of customer needs. And you can see here that many of the products are the same, so you'll have your tablets and notebooks that are used by both home users but office users as well. You've got integrated desktops here that are used in both the home and office. You've got desktop computers as well that are used, and Ken talked about the percentages earlier about that. In the business segment, or the commercial segment, there are a few products like desktop thin clients and then retail point-of-sale solutions that are unique to the business market. And then you get into some of your server-related products as well that are -- at least the large-scale servers that are industry product as well.

So in order to look at that and talk about it, you have to start looking at the numbers. And we've talked about the fact that there's two aspects of computers that make them different than water heaters and televisions. And that is, there is a wide range of models that are offered to the market, and then even more so, there are a large number of different configurations that customers have to choose from.

So, here, I'm just going to use an example that's from HP desktop computers because that's an area of concern that you'll see a little later. And what I've done is to give you some numbers that represent the number of different models that are offered and the number of configurations.

So looking at desktops, we've got -- for the year 2015, we've got 25 different model families of computers. And model families are not just individual skews or individual configurations. Within consumer, we offer 20 different model families of consumer desktop computers.

So the next thing you have to do when you're looking at the number of configurations that are in the market, is you look at the number of configurations. And what we've done here is, using the commercial as an example, we've looked at all the different hardware combinations that are available, which in this case are 117, and we also have 3 different operating systems that are available. And so that multiplies out to 351 individual configurations. Similar, but more pronounced, on the consumer desktop side, you got 143 different hardware configurations, but more operating systems, so you get 700. This comes up -- and that should read "total models." This comes up to a little over 1,000 unique models of computers that are offered. But that doesn't tell the whole story. Because within each model, you'll have hundreds of different hardware configurations that are available. And so if you do that, you do the math here, you get just over 55,000 unique configurations of desktop computers that we're offering to sale -- offering for sale in the market this year. And that's not unique to HP. This is pretty common amongst the large manufacturers, to offer that many unique configurations.

One thing I didn't do here, which would make this even exponentially greater, is I didn't include unique languages or keyboards. Because there are about 25 different languages that would basically multiply that number again. But that's an aspect of configuration that doesn't account for any differences in power consumption.

But the point to keep in mind here is that there are two things, there are a large number of models that are offered to the market, and a significantly greater number of individual configurations that are offered to the market to meet a very broad range of customer needs.

And this is just talking about the fact and giving an example of this 55,000 configurations using the HP desktop computer as an example.

And this is the point, this is why this

is important, you may not have realized that there's not only a broad range in the types of models that we sell, but there are a significantly greater, an exponential number, of individual configurations that we offer for sale to the customers in both the consumer and the business segments.

And the reason we offer so many different configurations is -- and it's expensive to do that -- is to meet the broad range of customer needs. And along with the span of performance that these configurations offer, you're going to see a span of energy use as well.

Okay. So now I'm going to talk a little bit about the impacts that we're seeing as a result of the proposal. So I guess you'd say the good news is, and it is good, is that most of our mainstream notebooks can comply with the limits that have been proposed, as least as far as the base tech limits that have been proposed.

There is a problem with it, though, and this is typical of desktops as well, that high-end notebooks are not going to meet that requirement.

The greatest impact of what we're seeing in the staff proposal as it's written right now is for desktop computers. And so somewhere around 60 percent of the consumer and commercial products that are on the market now would not meet those proposed limits. And so using the HP example of desktop computers, that would mean anywhere from 27,000 to 33,000 desktop computer configurations wouldn't meet the -- California's requirements that have been proposed.

And the problem with it is this impacts greatest in the area of performance. So for customers that require greater performance, the impact is going to be more substantial there than on the lower end of performance.

The other thing is that this is a major cost impact, and as you'll see later in some presentations that follow, it's pretty substantial. And where our computers could be redesigned to comply, we think it's a lot more than the commission is assuming. And, as I said, you'll see much more detail on that in the following slides.

Okay. There's a couple more impacts that we're seeing with the staff proposal. One is the power management proposal. And you would think that, because it's based on Energy Star, you know, that wouldn't be a problem, but there's two problems with it.

First is the fact that some customers buy computers without a power managed operating system so that they can take the computer once they've bought it, boot it up one time, and install a customer software image. We wouldn't be able to sell customers a computer with a non-power-managed operating system under the current rulemaking, the way it's written now.

The second one is that there are some operating systems that are not traditional operating systems with a traditional sleep mode to get to a low power mode. Some operating systems are doing the power management dynamically in the idle modes. So those would also be illegal for sale in California.

And, finally, there is an impact, a cost impact, associated with requiring 80 PLUS Gold Power Supply Efficiency for workstations.

And while we do offer many configurations with 80 PLUS Power Supplies, customers currently have a choice. And I don't have a number totaled yet, but we'll give it to you in our written comments to the staff proposal. There is a substantial impact of forcing everyone to order workstations with 80 PLUS Gold Power Supplies, and it's in the millions per year.

So here's a general concern that we have with the staff proposal, and that's the fact that it's really a one-size-fits-all approach to regulating the power consumption of computers. And I mentioned, the reason that this isn't harmonized with international standards that allow for that, and what I'm talking about here is the categorization you see in those standards, because it really prevent -- it puts you in a situation where you have to either specify a very one-size-fits-all high-tech base value so that you cannot impact high- performance products, or you set it low and then the net effect is many different configurations that are available for sale, particularly when a customer needs to do productive work, those are impacted. So that is a problem that we're hoping you would reconsider.

And in the next presentation by Shahid Sheikh with Intel, he'll get into the specifics of why that's important and why it impacts customers that have a need for more performance than, say, a basic user.

The other concern that we have with the current staff proposal is the fact that it's very aggressive. It goes well beyond the Energy Star 6.0 version specifications. And I'm sure that that's being done to futureproof it, but the net result here is that the Energy Star specification is an exclusive eco label. It's designed to target only the most efficient products on the market, and, here, this staff proposal goes well beyond that, and the net result is a significant number of configurations that are currently available and models are just simply not going to be available to customers in California.

And the point of that is, that this results in, not only significant risk and impact to the manufacturers, but the real concern here is that it's an impact and a risk to users of computers, particularly in the commercial space where people, they need computers with higher power, higher computing capability. And the thing that I'll mention here is that, the focus being on desktop computers is something that there is a market trend now where people are buying more and more laptops, but some customers still require the flexibility and the expansion capability that desktops offer.

And, as I think Ken noted before, and you're certainly going to see in later presentations, the power consumption of all computers is coming down while the productivity is going up.

Thank you.

MR. SHEIKH: Good morning. My name is Shahid Sheikh. I'm from Intel Corporation, and I will go through the discussion on PC methodology and framework in the context of global standards and Energy Star to outline some of the concerns we have on the CEC methodology.

So we'll briefly go over the overview in global landscape, because we are a global industry, we design and build products for global industry, so global context becomes very important in terms of how the computers are designed and used in the marketplace.

So, then, specifically, we'll talk about the issue about not having any categories. And I can briefly touch upon this, but this is a very big deal for industry, not having categories for computers. And Mark also addressed thousands of configurations that are, you know, essentially, sold for different categories of products.

And then we also going to talk about the target-setting approach and some of the departure from Energy Star framework, both categorization and target setting.

The reason I bring up Energy Star is because a lot of the, you know -- the CEC proposal is largely built on using some of the Energy Star definitions, targets, and adders -- or not the targets, but more adder approach. So we'll address why that's a concern to us, and then summarize.

So if you look at comparing with Energy Star and CEC staff report, so you have alignment on the duty cycles, which is a mode waiting for -- in both case of Energy Star and CEC. TEC equation is aligned, which is IEC 62623 standard, which is good. And on the definitions, we are aligned. So that's good news that those are the key areas that we are aligned. But then the other impact areas that there is a significant departure is on the product categories.

So Energy Star -- and we'll talk about it on the next slide, has a wall in terms of looking at the categories because computers evolve and the product -- you know, with the product evolution, there are several more categories. So with the new performance-score-based category system, you have six desktop all-in-one categories and six notebook categories. And right now, for CEC, they just have one category for all desktop all-in-ones and one category for all notebook PCs. And this creates a significant problem for the industry.

TEC targets, which is the standards, performance standards, Ken talked about, Energy Star is based on the top 25 percent in each category, the shipping product, and, you know, CEC is based on a cost effectiveness which is a lot more stringent than Energy Star version 6.1 at this point. We'll talk about, that we don't fully understand all the rationale behind it as we get to the next level of discussions.

On the TEC adders, which is based on a measured and analytical approach for Energy Star, it is largely aligned with Energy Star version 6.1, except there are no adders for this (indiscernible) graphic, which will be addressed later.

So our key concern is no PC product categories and more stringent TEC targets.

So why categorize? So the categories are used to group systems with similar capabilities together that allows a consumption, which is a TEC, which is a Typical Energy Consumption, comparison based on the capability. So you want to compare like products within the category so you don't have a one-size-fits-all approach. Similar to a motor vehicle analogy, so tablet and slate, in this case, would be like a motorbike, which has a higher miles per gallon, and tablet would be like a 5 watt -- you know, 5 watt power. And, here, the mode is transportation use and computer use is for web browsing and consumption. So if you look at a tablet/slate and then start looking at a motorbike analogy and looking at notebooks, which has a much higher -- which is a much lower miles per gallon than a motorcycle and it's a higher power and it has a different usage for content creation, and, similarly, for a car, the usage is much different than a motorbike. And if you look at the high-end notebooks, it's compared to like a pickup truck, where you have a much lower miles per gallon, and a high-end notebook has almost like a 25 watt power.

So, again, here, the uses are games, media creation, computational analysis.

So the analogy here is single-category approach for computers is like saying you're going to have a single miles per gallon for all vehicles in California, which we all know is not workable.

So let's look at the Energy Star evolution, because CEC proposal, to a large extent, looked at Energy Star model. So the Energy Star has evolved. If you look at back in 2007 over to 2014, in the last seven to eight years, the number of categories, both in the desktops and notebooks, have grown. And why they have grown is because the product continues to evolve. The PCs are evolving. Okay. With all evolution, Energy Star has to keep up with a product evolution so that the like products are compared, so that you're not comparing one product with other which has very different capabilities. So anywhere -- you're looking at the desktop where there were three categories back in Version 4. They moved to four categories in Version 5, and you're looking at six categories in Version 6.

You have a similar for notebooks, moving from two to three to six categories.

So the product, you know, PC product category evolution is key to Energy Star program success. And for a MEPS program, which is Minimum Energy Performance Standards, it's imperative to have categories as part of any California solution. Because, if you don't, then, essentially, you're going to set a target, as Mark mentioned, that either it will be too relaxed for the low-end categories, and will exclude products -- the high-end products on the market. If you set the target to high, then, essentially, which allows everything to pass. So we actually advocate setting appropriate targets within each category and defining those categories.

So if you look at the global landscape, I just wanted to bring it up here because that's important because that's how the products are designed today looking at the categories. And, you know, if you look at Energy Star Version 5.2 categories, Europe, China, South Korea, Australia, India, Brazil, everything is pretty much aligned to the Energy Star category approach. Okay? And when Energy Star 6.1 started with six categories, right now the programs that are in the pipeline after that are California and Japan top runner. Japan has not decided on the categories yet; and, right now, CEC is a single-category approach that we have.

So the categories should reflect the PC segmentation and is critical to global harmonization.

So let's talk about the PC segmentation with a desktop example. So if you look at a desktop form factors, you know, this is something that we addressed earlier as well, you have everything from a computer stick on the low end, many PCs, portable all-in-ones, all-in-ones mainstream, and enthusiasts tower with all the different OSs and different applications.

So a computer stick being a pocketable mini PC, you know, essentially, a small and powerful, fits anywhere, and then going from portable all-in-one. And then enthusiasts tower, which is a gaming content creation, max performance, et cetera. So you have different form factors because there are different applications and usages that are in the marketplace, that the customers demand.

So with those different usages, you have a different power profile. And here's a typical power, measured power, that we have from Intel in the lab. And this is an average of the measured power based on the shipping configurations. We looked at the sample size for different type of systems. As you can see that the TEC ranges widely because they have just different capabilities, and with those capabilities, you have much higher power demand.

So if you look at some of these discrete graphics by system, so we outline some of the most extreme graphics, G5 to G7, and the ones with the -- 1 to G5, these are the definitions per ECMA or Energy Star.

So, again, you can't just put a one-size-fits-all approach, because the market is not set up this way. You know, the way the products are sold in the market based on the customer demand, you just have different capabilities and different power profiles.

And we'll actually spend more time, as Chris was making an offer for an all-day workshop, or deep dive, we can actually give you demos of products that are in these categories and that are shipping configurations in the market.

So let's talk about the target-setting approach. So the Energy Star targets are based on the top 25 percent of shipping systems. And, typically, the Energy Star Spectra vision is driven by the increased penetration rate and based on the product transformations. Typically, it's three to five years after effective dates.

CEC process, it appears to be based on a cost effectiveness and technical feasibility. They are, as Mark mentioned, more stringent than voluntary Energy Star, which is a typical -- about 50 percent reduction in idle power for all desktops and all-in-one. And industry doesn't really have access to CEC database to evaluate and provide constructive input. We have the final numbers, but we don't have the bases behind those. We don't have the data behind those numbers. And this is something we really need to understand before we can respond.

CEC staff report references Energy Star Version 6, that one Qualified Products List, QPL, and percent of the system that may meet CEC targets, and we have some analysis on that we'll show you.

And, again, Energy Star Qualified Products List is a limited data set only. Okay? Because it's based on the Energy Star qualified system, which, by design, is only looking at the top 25 percent systems in the marketplace. Okay. So this does not comprehend and reflect all of the shipping systems. California should be looking at all shipping systems, because you're looking at a MEPS approach, which is a Minimum Energy Performance Standards, not a voluntary best-in-class approach.

Okay. So let's go look at what the impact is just looking at the Qualified Products List from Energy Star database. So if you look at -- and this chart may need a little bit of understanding. So if you look at the red line here, this is the actual TEC, measured TEC, on the Qualified Products List from the lowest to the highest. And you can see, based on the categories, that it starts pretty low and goes up all the way. These are all Energy Star qualified products.

And the CEC -- so then we looked at the CEC targets for the same products and -- along with the adders, so you see all these squiggly lines is where the CEC targets would be, that includes the adders as well.

So of the total QPL, Qualified Products List, there are only 12 percent of the desktops passing CEC current targets, and 84 percent failing. And out of the failed systems -- and this is what Ken was looking at, the improvement made -- so the average fail systems would have to improve an average 40 percent TEC reductions required on failing systems to meet CEC targets for the desktops in the next two to three years.

So -- and this is just looking at Energy Star data, not looking at the non Energy Star, which is the majority of the systems shipping. So which means this, actually, the number would be much, much worse. And the reductions required would be much, much higher if you look at the non Energy Star system as well.

So a higher failure rate across all segments, expect even higher percent failure on all shipping systems, as I mentioned, and 40 percent TEC reduction by 2018 on Energy Star systems to comply with proposed targets.

And we need CEC data to validate cost effectiveness assumptions.

Similar thing on all-in-one, this is a picture for all-in-one systems, that the pass rate improves a little bit. 30 percent pass rate, 70 percent fail rate, on an average 20 percent TEC reduction needed on the failing systems to meet CEC targets.

Again, this is only looking at the Qualified Products List, which is 20, 25 percent of all the shipments.

Okay. Notebook story is a little different. Here, again, one-size-fits-all approach allows a lot of the systems to pass, because notebooks are, as we mentioned, a lot more efficient. We have a 10 -- 90 percent pass rate and 10 percent fail rate. So here is the issue with setting up a one-size-fits-all approach is, that, you know, you have a lot of these systems passing and you don't have appropriate targets within each category because there are no categories defined for notebooks or desktops. So the key is to establish appropriate TEC targets within each category that we agree.

So, as a summary, industry does not have access to CEC data set to evaluate and provide constructive input. CEC assessments appear to be based on limited sample size and using best-in-class Energy Star Qualified Products List. The targets are more stringent than Energy Star Version 6.1. And establishing PC categories and setting appropriate targets within each category is key to success of PC energy efficiency program. So the one-size-fits-all approach does not reflect PC market segmentation in California. And CEC target setting and cost effectiveness criteria should be based on all shipping product, not just Energy Star Qualified Products List.

And on the cost effectiveness and technical assessment, really does not represent the ground realities, and we're going to get Gary Verdun coming up next to address some of that.

Thank you.

MR. VERDUN: All right. So my name is Gary Verdun with Dell here, representing ITI.

I'm going to try to address technological feasibility and cost effectiveness, to some extent. And I really only have time here in this show, the presentation, to touch on highlights. If we look at it from an overall standpoint, I see -- based upon the information we got from the CEC, I see the savings and cost effective analysis we've been provided in a draft report, to a large extent, is based upon non-public calculations, because we haven't seen what was used to actually get to where they set the limits.

Looking at that and some of the consultant data work, there's a bunch of false assumptions and misunderstandings about PC industry economics, power management of PCs, and, actually, proper test methodology. And I'll touch on some of these a little bit further, and, again, there's a lot more detail we don't have time to get into, and that's one of the reasons we're offering this later deep technical dive.

So just reiterating, so the methodology you get from the IOU studies that they reference within the documents over to their limits, we just -- we don't know how they got there. And we would certainly like to see more information so we can understand because, based upon our analysis, we'd -- you know, we don't see how you get there.

There seems to be a few trends. It seems that the percentage gains they've been able to determine on WERS systems have been applied to an energy stored database where, you know, I can go get a system that doesn't have the three legs that they based their desktops, which I have most of my focus, because that's the one that seems to be more severely impacted by these proposals. But if you take a desktop and you (inaudible) a high-efficiency power supply, you add low-energy hard drives and lower-power processors, which are -- everybody has to understand, are performance restricted, so as you drop DDP on processors, you get less work capability. But if you take the percentage gain from taking a system that does not have those three and then apply to the Energy Star database and the Energy Star database, two of those three have already been implemented in our requirement. So you can't -- it's double-dipping. You don't get to get that gain twice, because you can only implement the feature once. That covers both of those.

The other major concern is that there's absolutely no provision made for end user performance features. So the only desktop systems that I saw that got anywhere close to the limits they're proposing from a desktop standpoint, does not have key security features that our business customers require. TPM, vPro, a feature offered by Intel, when you add those features to a box, you add hardware, and you had software running on the platform, and that provides security features for business customers. And it is rather essential for their businesses that they have those features. And we have no kinds of adders for it, so, it's, again, a least-common-denominator kind of scenario and it doesn't appropriately look at things needed for performance.

And so I'll spend a second here and talk that there's a lot of discussion, even earlier, about energy efficiency. Everybody needs to understand that this is not at all in any way, shape, or form an energy efficiency regulation. This is an energy consumption reduction. There's no such thing as efficiency here because absolutely no work is considered.

And our concern with this kind of aggressive regulation here that focuses on idle and less is, it's the equivalent of saying all internal combustion vehicles in California shall have a -- shall implement an engine that has the same or less fuel consumption in neutral as a moped, because absolutely no work is considered whatsoever. And these products are there for our customers to do work with them.

So we'll go into a couple of particular issues on the data set that I was able to evaluate. So the supplemental technical report provided by the -- to the CEC on cost estimate issues, particularly in desktops, there really is absolutely no correlation that has been established between the measurements made in those tests and the way PCs actually operate in end users' hands. One of the fundamental issues there is, they took these systems and they put a new software image on it. Now, manufacturers that make energy efficiency improvements in a system that they ship to end users in the business, customers have two places that they can do optimizations in the platform. You can do it in the operating system bits that you put on the hard drive, and you can do it in the drivers that exist that also go on the hard drive. So as soon as they take that system and they put a fresh image, they've completely eliminated any OEM enhancements that exist in the platform.

And I can tell you that Dell systems ship with those enhancements, and I should know because I created them.

Now, it makes a fundamental issue with creating such an aggressive regulation when you don't know the correlation between the data set you're using to establish limits and what systems are in actual customers' hands. And, right now, from the information we've been provided, we have no idea what that correlation is, because that simple act of putting a new image on it changed the systems, and it was never established how that relates to the way the customers [sic] wind up in the end users' hands.

The other one is, in particular, the first thing they do when they take the system is they measure the baseline, which is the -- representative of the OEM shipped product. And they say they look at the idle power until it becomes stable. And this is another one of those cases with not understanding the systems, because when you do a fresh install, if "dot net" is part of the installation from Microsoft, particularly you're doing a Microsoft OS, you get a significant amount of work that's a deferred compilation of "dot net." So when they install the "dot net," they don't want it to take forever, so they confer a compiling. And it has to compile based upon the hardware and applications that exist on the platform. The first time the system goes idle for an extended period, they kick off this deferred compilation and those compiles start running.

I've seen high-performance notebooks where it's 20 to 40 minutes that it runs. But if you're only looking at AC power and you're looking at just for stable, you'd be surprised how stable they get the processor. The processor is at 10 percent utilization constant. And if you look at AC power, it's very stable and it looks like idle. It's not.

So we're just concerned -- another case where we really don't know if the data that's out there and that this is being based off of is actually accurate. Because what we've been able to see in the descriptions doesn't properly get a unit to where you can get actually real auto power measurements.

Let's see where we're at.

Ability to achieve power levels on components swapped on one or two machines, there's several issues.

The first thing is the sample size is completely insignificant. And there's a couple of other fundamental problems with saying that, because I can find pieces out there and build one of these, that anybody could possibly do it in production.

Another fundamental issue was assuming that desktops can go implement portable features at the same cost point. That's not how the business model works within the industry. First thing is, to a large extent, desktop parts, processors, and chips, that either don't have the same power management features as notebooks or they haven't been validated or it's actual silicon that has failed to meet the stringent efficiency -- I don't want to say "efficiency" -- the stringent energy limitations of actual notebook products. You remove that silicon from the market, what you're left with is going to cost a lot more, and it's going to be a lot more than $2.

The whole low power performance, back to the other analogy, if you completely don't look at the work that's being done on a product, then everything goes to the least common denominator and it's a system that has minimal performance. For our business customers, they pay for performance in these PCs, that's how they achieve productivity for end users. And if we take it away from them, they lose productivity and it costs them money. That's why they pay up for business performance kind of products.

And I also mentioned, you know, their percent reductions calculations, Energy Star already has two of the three legs that this percentage gain that they're being -- that's being proposed actually relies upon.

We have another -- this is one I want to point out, this whole PSC rightsizing. And so some of what was done here was reducing the size of the power supply. And that can be done to some extent, the problem is, as a manufacturer, I have to size a power supply so my customers can do what they want to do with it, upgrade it as required, and whatever they do to that product in their own modifications -- and many customers do that, particularly when they take computers and they put them on manufacturing lines, or, you know, running manufacturing lines or other kinds of applications like this where they have to do adders, they do their own customer design cards -- if I don't give them power allocations for those things, that are adequate, sometime during -- that product's going to fail prematurely and bring down a production line somewhere or bring down a chemical plant.

So, particularly, when you get into the business products, for end users, performance means they wait a little longer. And sometimes, for them, that's completely inadequate. For business customers, it's essential to the operation of their businesses. And that's why we size things the way they are. And you can't go so I can size it because I can run an idle test and it doesn't fall apart. It has to give them their enhancement capabilities they put into it, and it's got to run in their test environment because, as you get hotter or you run on a factory floor somewhere, you have to run fans higher, all these power levels go up, and they're completely different than just a pure idle test.

So we look at the costs that are provided here of $2 to achieve $69 reduction in energy efficiency. A big part of that assumes that you can -- back to our power supply thing -- that I can basically downsize the power supply and can find a cheap one somewhere and it's not really much of a cost adder. That's certainly not true for anybody who is trying to do it in high production.

When I tried to dig through the analysis and see what's there, that there was this -- there's a model set up for what the power supply costs, adders would be for going between different efficiencies, but does -- you know, I found a problem with that because it assumes that there's -- basically that we buy the parts. So the reality in PSUs going into PCs for us in production is, the guy who builds the power supply buys parts, and as you increase efficiency, he gets more expensive parts, he has to do more extensive testing, and he has a higher fallout. And then to those additional costs that he has, he has to have his own mark-up. Then it provides it to the OEM, or ODM, whoever actually builds the platform, and, of course, they add their mark-up, what's added. So that model does not meet the reality of the industry.

Here's another fundamental problem here is, ITI, the members of ITI, have actually gone and took our actual costs in buying PSUs at different size ranges, provided it to ITI, and IT has taken that data and blinded it, because we actually can't talk cost between manufacturers because that would violate any Trust Rules in the U.S., that data was provided to the CEC, and as best we can tell, there was 100 percent weighting to this incorrect, invalidated PSU model and a 0 percent weighting to the actual cost data industry provided.

One of the other areas I found in the analysis is, component costing models are projecting reduced price deltas. And when we get into hard drives, that's particularly erroneous from a -- if you look -- they're referencing the cost per megabyte of storage in a hard drive and presuming that we would follow that trend and it would result in cost reductions. But if you look at the trend in hard drives, that's not how it works. You get a hard drive, and it's a $50 cost on a hard drive. And over time, the capacity of that $50 hard drive goes up. As the storage capabilities -- you know, when I get a -- and I'm going to get a 500 gigabyte drive for 50 bucks where I used to get a 250 gigabyte drive, you know, that's twice the -- a 2X improvement in cost per gigabyte, but the drive did not get half price. So the costing model that assumes that the drives get cheaper based upon that is completely erroneous, because that's not how it works in reality. And that's a part of how this -- well, we assume that's a part of how this $2 cost adder came up and how it was justified.

So let's talk a minute here about what's been done. Now, part of the issue we see here is there's some changes in the way you cost and you calculate annual energy consumption. And I actually have three different methods here. This is data on -- since 2005 of our mainstream Dell business desktop. Went back -- this is our actual data. We don't usually make this public, but this is it. And I've tooken [sic] our mainstream high-volume system that we ship the most of to our customers and this typical configuration they buy. A couple of other things to note -- let me get a cursor up here -- is every system since 2007 has high efficiency power supplies, every system since 2006, has processor P-states and C-states enabled. Two of the three legs the CEC says we can make these improvements on, it's been there, and it's on every one of these systems. The other one is, every one of these systems ship with power management enabled, and well over half our customers leave that enabled and don't turn it off.

And I can tell you, from dealing with issues with consumers, that the majority of consumers out there don't know enough to turn it off and it probably stays on.

One of the things, if you take and project this curve out -- and I showed to 2018 -- but it actually has to be 2017, because we have to build the systems before January 1st -- that this is beyond the historical trend on energy efficiency improvement. And you also see this curve is flattening out and you see great big gains like -- so here's power supply efficiency. All these systems in here are built with gold. These are gold PSUs on -- in these last three generations. In particularly, this I3, I5s, P-states, C-states enabled, with Dell enhancements to make them even less energy consumption at idle, and Gold power supplies. So for these platforms, based upon the analysis we've been provided, the only leg we get to pull is more efficient hard drives. Other than that, these systems can't meet the limits. Well, there's actually two. We could put mobile processors and chipsets, and I'll touch on that.

The other one is, this blue line is using a Dell energy calculator model. For that particular model, we actually use work. We assume the system spends -- the user spends seven hours a day running SYSmark, which is way more performance that a typical user, and one hour a day running a 3DMark to represent another big unit of work. Eight hours a day of activity. We have a morning, afternoon break, and a lunch, and we do 250 workdays a year. And you can see, using that model, we're basically there now. So if you power manage a desktop today, you achieve what is being assumed that we can gain with all of these changes to the platform.

And then the red line on here is the TEC limit we would be required to meet.

Oh, one other thing is, so we've had about an 80 percent reduction since 2005 and a 2.6 times the performance. And this is the trend the industry is on. And this was done not because of regulations, this is done because of customer demand. Customers wanted to cut their energy bills and they continue to want performance.

Back to our comment about the least common denominator and, you know, energy-consumption-of-a-moped scenario, in order to make much more aggressive energy reduction trends, we have to give up performance. And performance is the thing that replaces the replacement cycle for the end users. If you knew PCs don't perform any better than the old ones, they'll just keep the old ones. So you would actually retard the addition of more efficient products into the market if you get -- don't allow for performance enhancements.

So there's several discussions -- I talked about that PC are mainstream desktop -- excuse me. So we already said we had two to three legs already in there. So the only lever we get to pull -- well, there's two, but we'll address one of them now. The lever we get to pull is high-efficiency hard drives. This is a comparison to a notebook. So if you look at the idle power adder, if we use a standard hard drive, we get 1.91 watts above a notebook at idle based upon the TEC analysis and the time we spend in the different states. Not a hard calculation. We can provide much more detail in a technical session.

If I get a high-efficiency drive, I get only three-and-a-half watt adders. But here's the real problem: For those customers that require performance, you know, once I put a performance drive on there, that is an 8 watt idle instead of a 5 watt idle and gives them higher performance and higher capacity, then I have to build the rest of the system with notebook parts. The notebook parts don't meet their performance requirements. It is impossible at these limits to build performance platforms. So my customers that need performance to run their businesses are inordinately negatively affected by the limits, the way they're set now, and, in particular, without having categories, doing a single category for everything. When you do a single category, that's what you do, is you basically punish people who need performance.

This is looking at another option for the same kind of platform if you need capacity. So one of the things that was referenced in the study is you get, you know, two-and-a-half-inch drives. They're -- you know, they're cost effective. In a certain range, they are actually cost effective, but that's as long as you don't need capacity. If you have one of these systems that I happen to have a business system and I need three, four, five, or six terabytes of storage, with those drives, my only option is multiple drives. And if I happen to need five or six terabytes, it's going to cost me 160 bucks more in two-and-a-half-inch drives than it would in a standard three-and-a-half-inch drive.

And, then, so this is just looking -- and this is all based upon the lowest price I could find on amazon.com for all the hard drives that the primary hard drive manufacturers list for these different products. So price isn't going to get a whole lot lower.

It's another case that, if you need high capacity, under this regulation, it's going to cost you somewhere between $50 to $150 per box to get it.

So back to our mainstream business desktop that customers buy. I have the high-efficiency power supply, I have I3, I5 processors with -- with the states enabled. I happen to have a TPM in it for security, because customers need it. I can't get there with the hard drive, so my only option is to go to a mobile chipset. If I go to a mobile chipset, what I've looked -- this is the minimum price, average price, and max price of I5 and I3 processors and chipsets on the Intel website, and it shows that for an I3, the best I can do is around an $85, $90 cost adder to move to mobile parts. And then if I'm at I5, I get lucky and it's maybe only $40 a box. And these are the only options we have.

I've spent time with our architects, talking about what we could potentially do on these business systems in this time frame, and it's the only levers we have to pull. We don't get to get to design new silicon in this time frame. If I go from Gold to Platinum, it buys me 1 percent, and doesn't get me 40 percent. So we -- at this time, we have no line of sight, other than pulling these levers, and they're significant cost adders.

So we touched a little bit on power management. And I know this is extensive, but I've taken our current mainstream business desktop again and I've got the actual measurements, and it's not actually one. I took an average of our I3, I5s on it with our features, then I went off and calculated what our long and short idle power levels would be required in order to hit the new limit. And, in particular, what we're looking at here is my corporate customers that already power management [sic]. The fact is, we going to make these changes for them, what is their gain? And we know that's 60 percent or more of the business customers that are here, and probably well over 60 percent of consumers, because they don't know enough to turn off power management, more than likely. What is the gain? Because the analysis used so far, all assumes that this 35 percent of the time in short idle -- and there's actually a problem with the current definition as was stated here earlier, because short idle in the Energy

Star specification is a proxy for both work and these idle periods. And the definition provided here earlier, it said it was the five minutes of user inactivity. Well, if that's correct, then users -- let's see what is the number -- then users 101 times a day walk from their systems 365 days a year to achieve the short idle limits.

Short idle is actually long in the Energy Star spec and it has gotten longer than 6.1, but it uses a proxy for both active and idle. So it's not all that.

And then the other one is, with long and short idle, the short idle actually indicates, to a large extent, user presence. And the way it's -- the 35 percent, the way it's set up now, assumes that -- effectively, that users would spend 8.2 hours a day, 365 days a year in front of the screen on every PC they have. And the reason it's that long is the proxy for active. And then we'll just send it --

Time? This is it. I'm right done.

So this is just saying, whatever those cost adders for my business customers that do power manage, and we've been providing them power managed systems for many years, if you go through that analysis, if they happen to power management, those changes are going to gain them about $2.33 over the life of the product in energy savings. That the majority of it can be done from power management. And if you actually looked at the installed bases systems in California, for zero cost, if everybody power managed those products, that would be 705 gigawatt hours per year and it could starts tomorrow. You don't have to wait three years and then some number of years for us to get more efficient products into the stream.

And so this is just about two messages: The people who already power manage, the business customers that can't get performance, won't get the savings that's being projected, a significant part of the end users won't, and then of the installed base, much of the gain that's being claimed here can actually be -- happen beginning tomorrow.

And that's it. I know I went a little over time. Sorry about that.

MS. SADOWY: Yeah. Good morning. My name is Donna Sadowy, I work for AMD, and I'll be sharing remarks this morning about high-performance computers on behalf of ITI and TechNet.

So what exactly are we talking about when we refer to high-performance computers? Today, what we're seeing is many of the components that we find in workstations are being pulled into desktop computers, you know, whether it's processors or high-performance graphics. The customers want features like customization; perhaps enhanced security; durability; expandability; the ability perhaps to extend life, especially on the desktop; enhanced management features; the ability to use with the largest displays, you know, the really great 5K displays that are being put on the market.

Sometimes, you know, the people want to use these computers with pro-level software applications. There's often a desire to use the computers for digital content creation. It could be game playing, digital editing. But something interesting that we were seeing also is that in notebooks, as we have driven down, battery power down, we see more and more interest in that population as well in adding, you know, these types of high-performance features to notebooks.

Okay. So who do we know use these types of computers? It's certainly, you know, California consumers. It's, you know, our population of students. It could -- parents that, you know, want that extra performance available in their homes to, you know, do productivity or to be there for entertainment, certainly California gamers.

Among the commercial side, a big user in the entertainment industry, which, you know, is an important industry for our state. Engineers want these higher levels of performance, whether it's Silicon Valley or other places. Industries like aerospace defense, smaller businesses, including things like medical offices where image quality is very important, and throughput, you know, the shorter time that you can share, you know, high-quality image is important for a hospital or for a doctor. We're seeing the UC system. You know, when we talked to researchers that are doing cancer research or, you know, even looking at things like climate change, I mean, they want these computers and often they want -- they see discrete graphics as an important part of the computers that they do want.

So, also, we're starting to look new technologies, new capabilities, like machine learning. We're seeing great use by start-ups, by, you know, the innovators in California, biotech industry, other industries. So this is the people that want, you know, these higher levels of performance.

Okay. In regards to the staff report, we do have concerns with the recommendations. While a lot of focus has been on, you know, identifying the impact on the average across the platforms, when we look at a desktop with discrete graphics, with the highest performance discrete graphics, we're actually talking about using -- designing these computers to use 77 percent less energy than the computers that are in the Energy Star database, which is a best-in-class. So this is a pretty dramatic, you know, need for redesign that we're looking at for these higher -- you know, the higher performance type of computers.

And, as my colleagues have mentioned, Energy Star computers are, you know, the best-in-class. So they don't represent the greater market where, you know, there's even more of a challenge to be attaining these very aggressive power reduction levels.

The schedule, you know, is aggressive as well. When we look at having products on the market in 2018, planning is going to occur in 2016 and 2017. So we -- as my colleagues have also mentioned, you know, there's issues around the cost effectiveness analysis, the data. You know, we're -- there's certainly a great desire to understand the staff report and to, you know, work with CEC going forward to make sure that we -- what comes out at the end, that we get this as right as possible.

So I won't go into this in detail. Gary Verdun just went through a lot of this information. But there are costs associated with doing things like moving to mobile computers, moving to higher efficiency power supplies. So looking at our numbers, we see a great delta between our numbers and the numbers in the staff report. So, again, hopefully, we can work collaboratively with CEC and all the stakeholders to address this type of issue.

Okay. As far as performance PCs, if we use the Energy Star categorization and say, you know, I2, I3, D1, D2 PCs, and Energy Star, as other people have mentioned, on desktops is a big concern, I mean, even just looking at Energy Star computers, we're seeing pass rates of 3 to 12 percent. So there's -- there's a whole other set of computers that aren't Energy Star, which creates additional concern. For integrated desktops, we see less of an impact. But, still, on some of these form factors, on passage rates, just looking at Energy Star is as low as 19 percent.

On notebooks, notebooks look fairly good when we look at the Energy Star data, but there's still this subset of computers that aren't meeting and, you know, with the desire to add more performance going forward, we think this is definitely something to look at as we go forward.

Okay. In regards to computer gaming, this staff report did note that casual video gamers in an October 14th report from Steam graphics users, that integrated graphics made up around 18.7 percent of the systems, that use was increasing from past usage. So, again, I'm -- this is saying that 80 percent of users in this profile are using discrete graphics. And when we look at the PC gaming market and we break it down into the different classes, you know, enthusiasts versus performance versus mainstream, by far the biggest number of users are the enthusiasts class, with a smaller performance -- I'm sorry, the biggest number of users are in the mainstream class, with a smaller percent of users in the performance and enthusiasts class.

But when we look at the interests of these consumers in, you know, buying hardware or buying, you know, audio systems or other accessories to support their interest in gaming, the majority of the spending is, you know, in this very small enthusiasts class. So that there's, you know, a higher -- or, you know, equal amount of interest in, you know, enabling their ability to do gaming even though, you know, the mainstream gamer is by far the great majority of the market.

Some of the issues we hope will be considered are issues like this where because of things like throughput, if operations can be completed more quickly with high-performance, components, there is potential to save a lot of time in performing the operation, which is a consumer performance issue. And then there's also the opportunity to save energy.

So it would be great if this was black and white, but this is, I think, just one example of, you know, where there's some complexity to this whole issue going forward that we'd like to explore more.

Okay. In regards to discrete GPUs, there is definite interest in the staff report in addressing these specific components. They're used in a wide variety of applications, from multimedia, productivity, simulation. For people like gamers, there's a dedicated class of gamers that perceive performance improvements through the use of discrete graphics.

In regards to GPU power in short idle, you know, that it is affected by the fact that it is rendering a screen. It's, you know, rendering -- it's actively engaged in doing that. There's RAM on the discrete graphics that's consuming power. So there are reasons why the -- you know, there needs to be some short idle power consumption by discrete graphics.

I think the graphics manufacturers have a long history of, you know, making efforts to improve energy efficiency, active and idle power, and that that desire continues as we go forward. But we feel very strongly that this regulation should not move forward in a way that it would potentially hurt California businesses or consumers because of, you know, removal of discrete graphics or other high-performance components from the California market.

So, in conclusion, we understand the drivers behind the CEC proposal. We understand, you know, the imperatives of climate change and taking action to address it. At the same time, performance PCs offer valuable functionality to the California market. I think we've talked in some detail about the concerns that we have with the staff report. You know, one size doesn't fit all, and that's especially true for these higher performance computers. Some level of energy allowance is needed for discrete graphics.

So, Ken, I notice in your slides you talked about low power consumption, and we agree, that's the right goal, not necessarily zero, but low is a good goal.

We are concerned that many performance PCs and components will be removed from the market. We do want to work with CEC going forward on analysis, data collection, additional discussion. We all share common goals. We all believe consumer choice is good, competition is good. California is the engine for innovation and creativity that's, you know, respected by the world. And, again, our goal is to work going forward with CEC and the other stakeholders to achieve these common goals.

So thank you.

MR. RIDER: Yeah. And I actually missed a point on my slide on the graphics card. You're meant to add that, you know, we really are looking for additional feedback on the graphics card adders. As mentioned in the staff report, we didn't propose any adders whatsoever, but a lot of that was from the very large adders in like the EEU and other places, and then being very out of sync with some of where the technology is now. And so we didn't have enough on the record to kind of establish what that new level would be, so we really look forward to further discussion and feedback in the process.

And, with that -- let's see here -- there's yours.

MR. COOPER: My name is Mark Cooper. I'm

with the Consumer Federation of America.

And I guess some people have made some references to what we put into the comments already. And so what I'm going to do is I'm going to dispense with all of my slides but one and walk through an argument I made actually here about a little over a year ago, where I presented a paper, the title of which was Energy Efficiency Performance Standards Driving Consumer Energy Savings in California. And, today, I want to explain why we think computers are an ideal place to start with performance standards and why the staff has moved in the right direction.

I think California is, in fact, once again leading the nation, and it's really important, that we need energy leadership in this country.

First, we believe that there are consumer pocketbook savings here. We believe the staff numbers and the cost-benefit ratios are really very good. And so we actually do believe that. And that's where we always start, from the consumer pocketbook.

Second, I think the potential energy savings are large. We've looked at the record to date, that was put in the proceeding before, and we think there are substantial savings to be had at a beneficial cost.

Third, and this is important, the energy consumption of these devices are what economists call "shrouded attributes." They're hidden in a bundle of technologies that the manufacturer selects and puts together. The electricity consumption is buried in a monthly bill. The consumer doesn't see it. They can't know exactly how much they're spending on it. It's not like gasoline prices, which are posted on every street corner, and they see every time they fill their cars up. It's a very different kind of product. It's shrouded. It's hidden.

And, actually, a number of mentions were made of automobiles and the auto industry, where we actually have had a remarkably successful performance standard in the product that the automakers will tell you is pretty darn complex, too. And they've actually managed to live with it, and they've supported the effort to double the fuel economy of their vehicles over the next 15 years. And that's where we hope the computer would end up, on the right side of history.

So if manufacturers really care about the energy consumption, they fix it. They've shown us that in mobile devices. It's a tremendous success. But because consumers, they don't feel the same market pressure on plugged-in things, they don't do as well.

We believe performance standards work because they command but they do not control. They're not telling which technologies need to go in. They're saying, Here is a standard, you figure out how to do it. And they unleash the technology. They unleash the corporations, the manufacturers, to figure out the best way to do it. And you heard some of that today. Different corporations have different product lines, they have different skill sets, and they will each figure out the best was to get to that performance standard. It's technology neutral. It's pro-competitive. It creates a certain market certainty, because it now tells you that you're not going to be undercut by your competitors who are selling cheap, inefficient crap. Right? We take it out of the marketplace. We say, You can't sell that kind of stuff. And that, we think, creates a market certainty around driving technology into the marketplace.

And I'll have more to say on that when I turn to some of the comments I have heard.

Now, let's see. Okay. So, finally, we always hear from manufacturers, the industry, that the world will end if you do this. And you heard an awful lot of that today. History shows that the projection of costs -- and these are dozens of studies -- offered by the industry compared to what it actually costs is a fraction of what they said in the first place. A fraction. Why is that? That is because they are good capitalists. And I love to say I am a devout capitalist. When you tell them, Here is your target, they go to work meeting it in the least cost manner possible.

You were told today that all of these products will be banned from the marketplace. No, they won't. The manufacturers will go to work and figure out how to meet the consumer needs in the lowest cost possible. Will the price go up? Yeah, a little bit. But this repeatedly shows, historically, dozens of times that when you adopt a standard, it doesn't cost nearly as much as the industry said in advance.

And, actually, that process started here in California 35 years ago when they told me refrigerators were going to be ruined by these standards. And for 35 years, refrigerators, they've gotten better and more -- less costly and more fuel efficient. The marketplace really works. And we need to have more faith in it.

So let me suggest a number of ways that I think we need to be careful about taking that -- listening to that knee-jerk reaction.

First of all, there's no doubt that there's a significant number of products out there that meet the standard. So that tells me that this is not about driving -- creating new technology, this is off-the-shelf stuff. The challenge here is to move it into the mainstream. We haven't gotten over the edge, as some commissions might be -- want to do.

Second of all, it's quite clear that consumers certainly should operate their devices as efficiently as they possibly can. We tell consumers to tune their cars and fill their tires, but that doesn't mean they should drive gas guzzlers. They will get the benefit of having a more fuel efficient vehicle if -- and if they also operate it correctly. The same thing would be true about a computer.

Clearly, there's a dramatic difference between labels and standards. They do different things. I have fuel economy labels on cars and fuel economy standards for vehicles. And you know what? They have different purposes. And the current standards will double the fuel economy of vehicles over a 15-year period, and the labels are trying to catch up and make sure they get it right.

But the interesting thing about the data you saw on labels, like Energy Star, it's a labeling program, it has failed miserably, I've been told today, because most of the stuff out there has not risen to Energy Star. The idea, when you put out a label, is you hope that people will have to compete so that they can make the claim and then they want to pull themselves up.

Well, I'm a decade or more into this program, and you've told me over and over again that there's all this crap out there. We need to address that market failure.

Now, as I said, the manufacturers worry a lot about cost, and then once the standard is passed, they do their job and they get it done at the least cost possible. I think the same thing will happen with functionality. They will work their butts off to make sure they deliver the functionality that their customers want and meet the standards. That's the way the process works.

So I believe that all those statements about the -- these products will disappear, well, the ones that don't meet the standards will disappear, and more fuel efficient or energy efficient standards will come into existence.

And, finally, I really do -- and I've been doing this a lot lately -- I want to finish with the role of California and efficiency standards and -- in the auto market. Fifteen years ago when California stood its ground and looked the auto industry in the eye and said, We need a lot cleaner vehicles in our state, and they said, We need something like a hybrid. And the auto manufacturers absolutely -- I'll get you a pageful of quotes exactly like you heard today -- This is the end of the world. It won't happen. Fifteen years later, the hybrid has gone from being a niche product to the best-in-class for the consumer. Every auto manufacturer in the world who serves mass market Americans has a hybrid for every kind of car they want. Fifteen years of revolution that the auto industry said was absolutely impossible.

Frankly, if the California Energy Commission can aspire to do that with these standards, that would be a tremendous feather in its cap.

Thank you.

MR. RIDER: Thank you.

Next up we've got the California IOUs.

MR. TSAN: Good morning. My name is Bach Tsan. I'm from Southern California Edison, and I'll be speaking on behalf of the Statewide Code and Standards Team that consists of Southern California Edison, Pacific Gas and Electric, San Diego Gas and Electric, and Southern California Gas, also known as the California Investor-Owned Utilities, or IOUs for short.

Thank you for the opportunity of commenting today.

Thank you, Energy Commission staff and Commissioner McAllister for your efforts regarding the computer standards, as well as the other Phase 1 topics. We commend the California Energy Commission for their continued leadership and vision on these consumer electronics topics. Standards are one of the most cost effective methods for the State to meet its energy and climate policy goals for Assembly Bill 32, C and E goals set forth by the California Long-Term Energy Efficiency Strategic Plan.

The roles of computers in this society is undeniable, but most energy consumption from computers is when they're idle and not being used. They're are demonstrated cost effective hardware and software solutions to reduce this waste. We are supportive of the CEC's proposal that will lead the nation in energy efficiency standards for computers. In addition, we also see several areas where additional energy savings could be realized. We will highlight several opportunities for additional savings in this presentation today. We'll also provide additional information in our written comments. We'll highlight areas where I believe the code language can be refined and to provide greater clarity in the marketplace.

I would like to introduce our

consultants, Nate DeWard of Energy Solutions, and Peter May-Ostendorp of Xergy, who provided expert technical assistance during our code and standards enhancement projects and their real-world adjustment factor addendum. The Investor-Owned Utilities will be submitting these comments to the docket and look forward to collaborating with the CEC and the industry on enhancing savings opportunities for computers.

MR. DeWard: Thanks, Bach.

So one area of improvement we see for the CEC proposal and analysis is just the estimate of energy use and savings potential from standards, supported most recently by the results from the testing that the IOUs conducted.

For example, here's a notebook, a Lenovo ThinkPad, selected and tested under the baseline Energy Star test method. And what this test method doesn't account for is the real-world conditions of computer use. For example, it doesn't account for when a user, for example, has a few windows open, such as, Word or reading a webpage, and not even actively using the keyboard or mouse. So the conditions not only -- they don't account for the peripherals, such as, docking stations, printers, or a separate connected strand in the case of this notebook.

So having tested a number of desktops and notebooks under these real-world conditions, or scenarios for real-world conditions, we see a considerable increase relative to Energy Star estimated TEC. The range here is a result of power scalability, of the form factors, but, nevertheless, these numbers are significant. And one additional important consideration is, these numbers don't account for any revision to the duty cycle. So accounting for a more realistic user profile, especially in the commercial sector, and in gaming computers, as we've heard about, these values increase to up to 40 percent for desktops as well.

The duty cycle used by Energy Star, which is what the CEC is proposing to use well, relies on only two out of a significant, large collection of studies. And so we continue to recommended that the CEC look further at these studies.

We've skipped over here. I pressed the N button instead of the page-down button.

UNIDENTIFIED MALE SPEAKER: Cycle

backwards.

MR. DEWARD: Cycle backwards.

UNIDENTIFIED MALE SPEAKER: (Indiscernible).

MR. DEWARD: All right. Great. Thanks.

UNIDENTIFIED MALE SPEAKER: Hey, you're not going to use my slide.

MR. DEWARD: If you give me permission, I will.

All right. So apology about that. Here we go. So for the Lenovo ThinkPad, the energy consumption is more realistically around 34 kilowatt hours per year, nearly all occurring when the user is not actively engaging with the product. So we recommend that the CEC use this real-world adjustment factor and a revised duty cycle to more accurately reflect the actual cost effectiveness and aggregate savings from the measure and re-examine what the IOU submitted to the docket.

And a final note, just for clarification, we want to make it clear that we think that the proposed use of the Energy Star test procedure is sufficient. And, in other words, we are not proposing any changes to how computers are tested for compliance and reporting purposes, only for the analysis for cost effectiveness and statewide savings.

So here's another -- a point about where we think there's room for improvement, for notebooks, in particular, for the proposed standards levels, we are supportive but think that the notebook standard levels could go further. From our thorough review of products available online, retailers, here's just one example demonstrating this point. Here are two products, equivalent Energy Star Category, I2; and key attributes, system performance, weight, screen size, and the operating system. And the one on the left meets the proposed standard levels at a price of roughly $500. The one on the right, roughly the same price, improves about a third -- with a third less energy consumed.

So, in other words, two units provide the same level of functionality, yet one is more efficient with no incremental cost to the consumer. And, again, these are just a few -- or this is one example, and we'll be conducting a more comprehensive analysis of prices and configurations and plan to submit these in writing.

And now I'll hand it over to Pete.

MR. MAY-OSTENDORP: Thanks, Nate.

So another area where the IOU team has been examining the staff's proposal has been with the functional adders that are included, and we're going to touch on just a few of those here, obviously, supporting those further in writing.

We're using examples -- these apply to both desktops and notebooks, but we're going to use mostly desktop examples. And kind of a common theme throughout these adders is -- as with a large person, the standard is, you know, making an argument for where we need to be in 2018 based on data that we have available today. And so that kind of forecasting is a theme for looking at these adders for us. Let's see.

So, first up, the secondary storage adder, the CEC staff has proposed a 26 kilowatt hour per year adder for secondary storage. This is, of course, based on Energy Star Version 6. And what we've tried to show here using a public data set, is that basically three-and-a-half-inch -- the standard three-and-a-half-inch drives used in desktops today can actually meet that secondary storage adder in fairly large numbers, number one. Number two is that if you move to the two-and-a-half inch and solid-state technologies, they can actually clear that adder fairly easily. And then, of course, if you think about the fact that this is an adder for secondary storage, it's not the primary drive that's required for -- that's hosting your operating system, we feel that there may be opportunities for more aggressive power management and those secondary drives. And so we'll be examining the overall stringency of that adder in further detail for the written comments.

Second piece, another example of an adder where we're kind of looking to the future is memory. The staff proposal includes an adder of 0.8 kilowatt hours per year per gigabyte of installed physical memory on a system. Now that adder, again, comes from Energy Star Version 6, and it's based on a data set that was collected in the 2010, 2012 time frame.

Well, in that time frame, and since, DDR2, and more recently DDR3, memory technology has dominated in desktops. And what we see coming for the 2018 standard is DDR4 memory, which brings with it additional significant power benefits, up to 40 percent power savings, and deeper power management device states that will be enabled on that. So we'll be examining, what would the adder look like in a world that's dominated by DDR4 memory technology and what might be an appropriate level there.

Another important piece that we've been looking at and we've been hearing about a lot today are graphic adders for discrete GPUs, specifically. This is something that the IOUs have been examining for a number of years, partly in collaboration with NRDC and CLASP. And there are a few things that we've been looking at with regard to the current proposal. Number one is that you can see that this is a combined data set that goes back to a 2011 project, and you can see with each successive data set that we've collected, 2011, 2012, and now 2014, the most recent, we're seeing the trend for the incremental power requirements of a discrete graphics card drop pretty precipitously, to the point that, you know, for some of these higher performance cards, we're seeing something like a 50 percent drop over the course of just three or four years. We are conducting ongoing research in 2015 to get the very latest technologies into the data set.

There's kind of another piece that's been going on at the same time as we've been conducting this research, is that integrated graphics products have been becoming significantly more capable at basically providing some of the same capabilities as a G1 or a G3 card, but with no significant power increase. These are products that are integrated right into the CPU itself. So it kind of calls into question, Do we really need to worry about this area down here, when integrated graphics is handling that pretty capably.

And then, of course, you heard reference to hybrid graphics before. That's a technology that is widely used in notebooks and allows for powering down of the graphics card in idle modes altogether.

So we're examining those kind of three trends in support of what the CEC has proposed for graphics adders.

And I'll turn it back over to Nate.

MR. DEWARD: Thanks, Pete.

So I just want to emphasize the point that we see opportunities for savings and are emphasizing those savings -- when the computer is not working, it's in idle states -- and also just that future progress -- you know, Y standards, future progress is not guaranteed. For example, in the late 2000s, we saw power-hogging graphics responsible for a bump in idle mode and power management, you know, it wasn't active, as well as the potential for emerging always on modes. And so we want to make sure that that -- even though there has been progress, we want to make sure that we're not continuing to see energy consumption increase.

And then an important part is, in terms of the sales of these products and the availability of them and the consumption overall, we still see that sales are significant, even for desktops, and especially notebooks as those continue to be popular.

So those are our comments. Thank you.

MR. RIDER: Thanks.

Next up is NRDC. Okay. Pierre.

MR. DELFORGE: Okay. Good morning. Pierre Delforge, NRDC.

I would like to start by thanking the Commission for pursuing computer efficiency and for hosting this workshop today.

I would like to focus most of my comments on the feasibility of the Commission's proposed levels; but, first off, I'd like to remind ourselves why it's -- this is a key opportunity for savings and why NRDC has this as one of our key priorities in terms of appliance efficiency.

As we saw early on, computers and monitors and displays today in California are responsible per the Commission's estimate about 8 billion kilowatt hours of energy consumption today. We actually think that's actually a low estimate. EIN numbers put them at about 12 billion kilowatt hours. And neither of these estimates actually include the, you know, real-world use and real-world duty cycle that the IOUs mentioned early on. So we could be looking at a lot more, both energy consumption and a lot more savings that we are accounting for.

And, you know, to put in terms of, you know, energy carbon and dollars, you know, this is a very significant both use and saving opportunity.

It's not only a large use, but -- and that's what I'm going to cover today -- it's a large opportunity for saving and using existing technology. Not talking about, you know, future theoretical potential here. And we're going to demonstrate both in my presentation and in the next presentation a demonstration how this can be done with current technology.

First thing I'd like to put computer consumption in perspective. If you look at -- these are the four main -- no -- four of the key form factors that you have on the market today. And if you compare a notebook with a desktop, a desktop is about three to four times the same energy consumption as a notebook. And the notebook itself, although it's a mobile and relatively efficient product in general, is also 5 to 10 times more than tablet. Both are computing products. And, in this chart, they all in idle mode, meaning they don't have any work to do, they are -- basically, the comparison that Gary used with the car, they are the traffic light. And, you know, they're not going anywhere. There's no work to do. So there's really no reason why they should be using that much more energy.

You know, I drive an eleven-year-old Honda, and it -- at every stoplight, it stops the engine. And, you know, whether you drive a gas guzzler, a Hummer, or a sedan, you can switch the engine off when you're at the traffic light and you can restart instantly. And you don't have to do that yourself. The car is able to do this today. It's been able to do this for a long time. I think it's time for the computer industry, that it's the same thing, when you're in idle, you don't need to have your idle on, especially long idle, but even in short idle, you can power it down to a large extent.

The industry has done a great job of bringing -- innovating and bringing new technologies which are capable of much lower power than it was required just a few years ago. When the current Energy Star Program Version 6 was being developed between 2010 and 2012 and adopted in 2013, same time for the EU to one standard for computers.

The data that was used was computers and the market between 2010 and 2012. That's three to five years from now -- three to five years ago. And we're looking at a standard three years from now. So, basically, there's a gap of six to eight years between the data that's used for current standards and labels and when we're looking at the standard to be available. That's, you know, several generations in terms of computer technology.

And if you look at what's available today, we have -- that wasn't available then, we have, you know, low power processor states, you know, C-67, the other ones that Ken mentioned, we have motherboards that have deep power management that can switch off in active or disable in active, you know, components and controllers and others. We have the PCIE low power sub-states. We have graphics switching or hybrid graphics that are now available on desktops. And so the power supply technology has evolved as we've seen early on. And we also have this -- and I'll get more into this later -- this deep power management. I'm not talking about, you know, the Energy Star SEPI 50 minute power management. I'm talking about the realtime power management that mobile and tablet devices do when you push -- you know, when you switch the button, or even if you're not doing anything with them, they go to a sleep state right away. It's millisecond-level power management. It's not, you know, 15-minute in power management. And, you know, Apple has a word for this, you know, "keystroke sleep." If we implemented this on more computers, we'd have -- you know, we'd be able to meet these levels without any problems.

So to demonstrate this, we looked -- we partnered with Aggios, who's going to show the demonstration. So I don't want to steal their thunder, I'm just going to give a quick intro what the results are. So the -- this chart shows two computers. On the left, you have a consumer computer, and we were using an MSI board, which is a motherboard with deep power management capabilities. And, on the right, you have a standard commercial desktop. We did two things, you know, on each computer. First, we implemented the low -- the deep power management on the motherboard in BIOS and other operating system settings. And you can see on the left, the difference between the blue and the red bar, shows that we were able to reduce nearly by half the power consumption of the computer just by implementing -- by enabling the technology that's already available in the computer that wasn't being activated as the computer was sold -- as the components were sold.

And, then, we implementing a better power supply and not, you know, not a very high-end, very expensive power supply, just an 80 PLUS power supply, we were able to reduce the power consumption by 61 percent, and to go lower than the proposed levels by the CEC.

On the commercial computer, that's an off-the-shelf computer. We were able to do, you know, the same thing. And, there, the major reduction comes from the power supply. I was actually shocked to see that this computer, which is a commercial computer, mainstream, had a 55 percent efficient power supply in idle mode. So nearly half of the energy consumption of this computer goes into the power supply without reaching the motherboard. And this is ten years after we started the 80 PLUS voluntary program. This is maybe 20 years after the start of Energy Star. And we're still seeing, you know, 55 percent efficient power supplies in the market. I think this is a clear sign that, as Mark mentioned, labeling and voluntary programs, while they are necessary and useful, they're not sufficient. You know, to transform the market, we need both standards and voluntary program. And there's no, I think, better proof of that than this 55 percent efficient power supply.

I would like to mention that these two strategies are -- the first one is just software, so zero cost, you know. Well, the cost is just engineering, which is spread over millions of units. The second one is an inexpensive power supply, so it's not something that is going to add significant cost. And so both -- you know, just these two strategies -- and we're not saying these are the only two, they're just two simple strategies -- very cost effective and have no impact on latency for wake-up or performance. So that's with desktops.

We looked at integrated desktops, so desktops with the screen, like the iMac and the HP L81. So these are computers available today. The iMac is at 73 kilowatt hours annually. The HP notebook -- and these are comparable in terms of performance and specs, you know, same-size screens, similar processor speed, memory, et cetera -- it's a little bit -- about 30 to 40 percent higher, but both are lower than the CEC proposed limits by about 10 percent for the HP model, because they have slightly different adders so the HP model should be compared with 125 limit for CEC, and the iMac should be compared with 100 limit for the CEC level.

So out of the box, without any optimization, these two mainstream desktops, integrated desktops, are able to meet the limits.

And Energy Star, you know, not even talking about this because they're more than three times as high as what these computers really need.

And the difference is even more dramatic for notebooks. So we're looking at one of the most efficient notebooks on the market. But this is a high performance, or relatively high performance, notebook. It's got, you know, 8 gigs -- or one model even have 16 gigs of RAM. It has an I5, co-I5 processor. It's a high-performance display, 4 megapixels. And it's -- the energy consumption is 15 kilowatt hours annually, which is less -- well, less than a quarter of the CEC proposed limits.

The next model that we looked at, the Dell Latitude, is nearly three times as much, but still about 20 percent lower than CEC's limit.

So, you know, I think here we are looking at, if we keep the standards, the levels as proposed, this is going to be a non-standards by 2018. It's not going to save any energy. And I think it's important that -- you know, we encourage the Commission to revisit the proposal to take into account the technology that's available today and not the one that was, you know, there three to five years ago. This is using the latest that -- the Apple product uses the latest Broadwell chip. It's idling at 4 watts in short idle and 1.4 watt in long idle.

I mean, this really shows that we have the technology available today to meet much lower and much more aggressive limits than the one proposed.

So how does the Apple product achieve this? I want to -- you know, I talked about realtime power management early on, so this -- Apple has a nice graphic on their website on how to do this. I mean, this is basically managing the power of the computer just like they do on a mobile phone or tablet today. You know, it's software power management at the millisecond level, making sure that -- you know, this chart here shows the power use and the processor activity between each keystroke. So when you type on the keyboard, between each keystroke, they put the computer to very low power mode. And this is available today using Intel and AMD technology. It just needs to be implemented and activated. And when you do, you can reach extremely low levels of power, as we've shown in these examples.

So, in summary, we support the -- and we believe that the CEC proposal is technically feasible today at very minimal cost. We don't need, you know, two-and-a-half-inch drives or SSD drives on computers. We don't need mobile parts on desktop computers. We can achieve it with deep power management and reasonably efficient power supplies.

We think that the Commission's proposal, the enhancements that we suggest on integrated desktops and notebooks, can address a large saving opportunity without any impact on performance because those are just addressing idle mode, and also that this is a performance-based standard. It doesn't prescribe how to do (indiscernible). A large number of technology is available today to achieve these standards.

This being said, we recognize the consensus by industry about, you know, maybe niche products and markets. And, you know, we're open and committed to trying to find solutions that will work for all while achieving these levels of savings.

Thank you.

MR. RIDER: So this brings us to -- sorry, excuse me -- Aggios. I'm actually going to pass off presenter rights.

(Pause.)

MR. RIDER: And I suppose just to keep these flowing, while we're waiting for this to go, I just want to remind everybody about the blue cards. If you already know that you're going to want to make a comment once we get through this last presentation, go ahead and fill out one of these blue cards here and we'll go straight to these as soon as we get through this final presentation.

MR. ZIVOJNOVIC: Hello. I'm from the company Aggios. And Aggios is a California start-up. Our technology is in software defined power management. This is the layers of software which sit on top of the hardware, and basically most of devices are responsible for the best power management performance we can get.

MR. RIDER: Can you try to speak more directly into the microphone, please.

MR. ZIVOJNOVIC: Yup, will do.

MR. RIDER: Thanks.

MR. ZIVOJNOVIC: So these layers interact both with the hardware and the operating system. And this is where our passion is. Why we are here is to continue to support the CEC's energy efficiency activities. We started doing that in 2013 on a couple of different projects among other (indiscernible) box devices.

We are also strong believers in mobile efficiency. The original team comes from companies Qualcomm and ARM. These are the leaders in power management for mobile devices.

And I'm also here to increase the

awareness of the new Eee PC Infinity 415 standard for energy proportional computing, which has gathered a large number of corporations, their technical experts, to advance the innovation and the alignment of the industry when it comes to energy issues.

Today, the presenter of the demo will be Mr. Davorin Mista. He's our VP of Engineering. And my name is Vojin Zivojnovic, and I'm the CEO of Aggios.

We think that, from the old days when we started putting these transistors together, we were very focused on functionality and we wanted to see the performance. And, yes, this is our legacy. That's how we built all these wonderful industry we all enjoy to be part of and to be users of. And then, gradually, we shifted to performance, from performance to efficiency. And this is a long way to go, as this slide -- which I refer to Professor Rabaey; he's the Chairman of our Technology Advisory Board -- shows the nature is ahead of us. Nature still design systems which perfectly hunt in maximum performance, but even better sleep when they need recuperate and be ready for a new hunt.

What is behind the power and the power consumption and the whole deal about power management? It's really not rocket science. It is the fact that the software has a couple of buttons on the left side, you see here, these are the operating modes, the frequency, and the voltage, it tunes these power meters and, in this way, impacts the operation, the clock frequency at that moment, the supply; and based on the couple of states within these components, the components consume power.

Now, what about the complete system? Of course, such a complete system consists of a large number of such components, which have their own rules, have their own logic, and have their own impact on the complete system power consumption.

So the device power is really a complex combination of component power, as well as the intricate power dependences. Which, yes, we need experts, we need people of knowledge, to combine them in the way so that the complete device performs as we request. And, yes, the best understood results came from the application of mobile space, not only from industry, from academia, from researchers, as well as from all the imagination have, how to have a watch or a phone or a tablet which will last for days, hopefully, one day, for months. Like we used to have our old TI calculators, which lasted a very, very long time, and we should have this vision to go that path.

So, today, in this demo, we will show you two systems. Both systems use common software and components. Number one is an assembled desktop, which consists of a couple of standard components you can buy online or from Fry's or Micro Center. And with the first demo, we would like to show you the impact of the software defined power management; how, basically, the software changes can improve the performance of that device. And, yes, we are focusing on the idle states, which are discussed here at this workshop.

The second one is a similar demo, but it involves an off-the-shelf desktop. And it shows the impact, how the improved voltage regulation, the improved voltage conversion, can help reduce the power consumption of the device also in the idle states.

So, with this, I will hand over that to my colleague, Davorin Mista, who will now conduct the demo.

MR. MISTA: Okay. Thank you.

Okay. So the first demo I'd like to show is the custom PC. I've got this videocamera here. Basically, what you can see here is the motherboard and, back there, the power supply. And the motherboard is connected to the power supply through these -- this setup here that we have. And all these are power-measurement shunts. And that is fed into this data accusation device, and then the actual results are shown here on this PC.

(Pause.)

So this software now visualizes the DC power measurements that we're making to measure the individual contribution of the different components so we can identify how much power the hard drive consumes, how much the CPU is consuming, and how much power the different components on the motherboard are consuming. And so, here, for example, we can see the CPU power consumption broken out.

And then we also have the AC power

consumption here with a power analyzer. So this 22 at the bottom, that is the AC power consumption.

And the computer that you're seeing here is now in the default configuration. This is the configuration that it was in when we purchased it. And it takes about five seconds to wake out of idle. And so, now, I'm going to make some changes here in the software to make the -- bring the computer into a more optimal setting.

So these changes comprise changes we had to make in the registry, changes in the Windows configurations. And there's also software that is included with the MSI board, and this software allows to also make custom changes to power specific settings.

(Pause.)

Okay. So, as you had seen, we had a default idle state, the computer ends up at about 22 watts, which is after sufficient amount of aging. We ran those computers for, basically, a whole weekend after first installing. This is the default configuration, basically, here. But we did wait until there was really no more background processes going on and just a standard

Windows operation. So we did have to change here a little bit the display timeout to turn off after only one minute so that we can demonstrate it here. But, basically, what you will see is that, once a display turns off, the power consumption will pretty quickly -- should go down to 16 or so watts. And it should also eventually reach 12.4 watts, which is when the hard drive turns off.

(Pause.)

So for the purposes of this project and also during this demo, all the changes that we have made were manual changes using the available software. But, typically, the Aggios software we're developing does this kind of thing automatically so that it dynamically picks the right operating points, turns off unnecessary services and devices, and puts them in the optimum power state.

So we will have to wait another 30 seconds or so to enter the mode with the screen off, which is, essentially, an idle mode.

We know that Energy Star defines idle to start at 5 minutes, long idle at 15 minutes. But -- and that's also how we measured it. But, for this demo, we shortened it. And normally go down fairly quickly. Of course, now, as you can see, it briefly went up. Windows has a tendency to schedule some background tasks to start as soon as the screen turns off. So the power consumption can initially go up as soon as the screen turns off because Windows has a bunch of tasks lined up to start right then.

But now we are already going down to 17 watts and we're at 16-something. So if we leave this running for five more minutes and maybe later during lunch, you should see this being at around 12.4 watts. But we're not going to wait for this state now any longer. But we already have achieved an improvement from 22 down to 16something through just software changes in the default configuration.

So just to also show that the latency to wake up is identical as before. The latency is dominated by how long it takes for the graphics and the monitor to turn back on. So for a user, there is no difference here at all. And if we run a benchmark -- I'm starting this Intel Extreme Tuning Utility and that one has a benchmark built in. It takes about a minute and a half for that to run. So we'll leave that running, and I'll switch to the next demo. But the benchmark will, essentially, show that there's no degradation in performance whatsoever.

So I would like to switch to the second demo. So the second demo shows a commercially available desktop that we used. And we took the motherboard out and we did the exact same analysis as we did with this custom PC. And we identified that there was a huge inefficiency in its low power state, when it was in an idle state, and it was running at around 22 watts in idle is what we measured. It was using all the default configurations. We, basically, plugged in the box, let it run over a weekend to make sure that any kind of initial settings and background compilations and anything has been completed. And it was -- stayed at 22 watts, pretty much there. And then we started doing all this analysis, and we identified that the power supply is very inefficient when it comes to that particular state. The efficiency is between 50 and 60 percent, depending on where exactly you are in the power range.

So now -- the PC, at the moment, is in a state -- this is also a power analyzer that's supposed to show you the AC power. We have had problems with this device, because once you go below 10 watts, then it stops showing the value. And there was an auto mode that was supposed to work, but -- so, whenever the hard drive turns off, we go from 12-something watts down to 9.8 watts. And that's when this device then refuses to display it.

So, essentially, what we have done is we have taken this picoPSU -- this is a PSU that looks like this. It's very minimalist. It is only rated for 160 watts, so, yes, you cannot plug in some massive high-end graphics card. But we were, basically, just trying to demonstrate how much impact a better PSU can have in this kind of an idle mode. And we were able to -- with this PSU, we measured an efficiency of around 88 percent in that state. So the power consumption dropped by over 40 percent through just changing the PSU alone.

So, unfortunately, it looks like the power meter is not cooperating. Oh, here we go. Here we go. So, now, it is showing 9.7 watts. So the number on the left is the wattage.

And, now, if I wake up the system -- again, the latency is the same -- something close to five seconds. So, now, that it went over 9 watts, it also now refuses and I have to go and change the mode so it can -- so, now, we're here at 15 watts, but the computer is now running.

Yeah. So, essentially, it was a combination of the -- what you saw here is, the 40 percent savings, just through the power supply and then making some of the software optimizations we also made here that we reached under 10 watts on a commercial desktop.

MR. ZIVOJNOVIC: Thank you, Davorin. So, basically, this is not a scientific experiment. This is --

MR. RIDER: Can you stay close to the microphone?

MR. ZIVOJNOVIC: Oh, sorry. It's not a scientific experiment. It's an experiment of a couple of experts who pretty well know power management for different devices.

And we believe that, based on these analysis and our general knowledge, that components can meet expected power levels and that they are available already today. Of course, costs, organization, marketing, and all these commercial issues have to be discussed.

We see a major work in front of us: How to improve the way we select and combine such components. And this is, obviously, done by some vertically integrated companies very well, which we've mentioned in previous presentation. And I think the industry is on the right path. But as our demand for more sophisticated devices grows, the way -- how we combine these components and how we tune them I think will be a determining factor.

Of course, there is some improvements in the wattage conversion area, which you have seen here in working, and there are movements that a lot of that is done on chip that we eventually one day will not need all the voltage conversion off the chip and even off the board. But that is coming as a next step.

And, also, as a last point, I would like to mention that new unified technologies -- when I say "unified," unified in terms of plug loads and mobile and internetal things. And related standards are really necessary for cost effective deployment of complete, reliable, and long-term reliable solutions, power management solutions across the industry.

So I would say, in my experience and the experience of my team, we see a very bright future, that we will reach phenomenal levels of power reduction and energy efficiency in these devices. And that, obviously, academia has to play and continue to play a good role. Innovation, which we, as a start-up, hope are part of that, as well as all the owners who participated today.

So I see a very bright future for this whole field. And, you know, thank you very much for your attention.

MR. RIDER: I think he's trying to show us the benchmarks.

But, in the meantime, I just want to say, you know, thank you to everyone who presented. That was the last presentation. And once we see these numbers here, then I want to take a poll. So we're at 1 o'clock right now. I would prefer if we could go straight into some of these comments and push on through and then we'll break for lunch. But I kind of wanted to get a feel from the room. Is anyone here having blood sugar issues or anything? Okay. All right. Well, then we'll go ahead and continue on to the public comments.

So I have a number of blue cards, so I'm going to start with these, and then we'll go to general comments. The first up I have on the cards is Gary Fernstrom from PG&E.

Yeah. And if you can keep it -- just generally, not to you specifically Gary -- but if we can keep it going, that's probably a good idea.

MR. FERNSTROM: I'm Gary Fernstrom representing PG&E. I'll be quick and take only a couple of minutes.

Chris opened this morning for industry and showed the relationship between computers and productivity. I think there's no question that computers have brought us enormous productivity improvements. That doesn't mean that they necessarily need to be less efficient than they could be. I think we can have the full utility and service that computers bring us at less energy use by carefully designing and choosing the components within the computers and the manner in which we operate them.

Mark talked about the diversity of customers and configurations. And this is true. But there are some common functions and components within computers that offer the opportunity to allow this diversity of functionality while still reducing the energy consumption. For example, the power supply. So no matter whether you have a high-performance, multifunction machine or a simple, less capable machine, you still have a power supply, and the power supply can be made more efficient.

So irrespective of the diversity or types of customers, there are commonalities within these products that allow for efficient improvement.

A comparison was made to automobiles, and I thought that was a very clever comparison. We could go out and get a Ferrari and that would probably be the ultimate in automobile performance, unfortunately, the Ferrari stopped at a traffic signal or caught in commute traffic isn't performing very efficiently. On the other hand, we could go buy Tesla, and the Tesla has enormous high performance, yet when it's stopped at a traffic signal, it's consuming very little or no power at all.

So the computer industry is really no different in terms of the components it chooses. We can have high performance yet minimal energy consumption when machines are being used at less than their full capabilities. And it's that range that we want to see developed.

I think the utilities have shown that products are available that have low energy consumption and high performance in the market. Energy Star attempts to encourage manufacturers to move to that level. So there doesn't, to me, anyway, seem to be any reason we shouldn't be able to move to reasonable efficiency standards given all of these considerations.

Thank you.

MR. RIDER: Thank you, Gary.

And, you know, the automobile comparison is almost irresistible, but, you know, really, we're talking about where the driver is not even in the car. I mean, these aren't even in use. No one is driving these things. This is more like the driveway. And nobody leaves their car running on the driveway. But, you know, they do leave their computers when they step away from them and aren't using them. And, you know, if everyone turned off their computers when they walked away, this idle mode wouldn't even be a conversation.

So I have -- next is NVIDIA, Ned Finkle.

MR. FINKLE: Hi. Thanks for the time to speak.

First of all, I want to support CEC's attempt to find constructive ways to save energy in our industry, so we're not at odds with that. Our industry is an enlightened group of people, and we share those kind of goals.

We would like to be a part of that collaborative discussion, if I could call it that, and I don't know that we have been so far. We really need the data sets. And I really want to kind of back up what I think I've heard from our other industry partners, that we need to see more to the underlying data sets that you've been using to produce that. So that would be helpful.

The other thing in watching the presentations are -- I think we should be careful with analogies to other industries. I love automobiles. I'm a fantastic proponent of cool things within the auto industry. I don't think if you measured our PC industry and all the aspects of it, you would find the comparable curves. We've been fantastically innovative. And it would be amazing if we could only have an auto industry that performed like the PC industry. So that would be something that we need to be care -- it's not easy just to say, if we just do what we did to the auto industry, the PC industry does the same thing, because it's on a completely different curve.

NVIDIA, for instance, we are in supercomputers, the latest and the most advanced all the way down to handheld devices. So we think a lot about power already. And so it's not -- it's on our mind. We don't absolutely have to have pressure to do it. We do it naturally and competitively.

So I think, as a Californian, I'd also say, let's be careful not to degrade our innovative status as a state. Let's be careful to think about the real problems we're solving. We're leading in so many categories -- machine learning, biotechnology, research -- so many areas, and those depend on these performance products that we're talking about. And simple legislation that seems well intentioned could really disrupt that.

So, in summary, let's be careful; let's solve the right problem; and, please, we need the data sets.

Thank you.

MR. RIDER: Yeah. And I meant to recognize, too, in the earlier presentations, you know, I appreciate all the points that, let's get together and talk more about this, and I think that's exactly the right next steps coming out of this workshop. So appreciate the offers from everyone, industry and other advocates, stakeholders in general, to do that.

Next, I have Peter May-Ostendorp from -- is it Xergy? How do you say it? Just Xergy? How do you even say that company? Xergy? One of those things.

MR. MAY-OSTENDORP: I'll just repeat it again.

Hi. Thank you. Peter May-Ostendorp from Xergy Consulting on behalf of the California IOUs.

I wanted to just address a couple of points relative to the technical materials that the IOUs provided on computers. There were just a couple of maybe misconceptions that I wanted to address.

I think, Gary, in your presentation, there were some discussion around the correlation between the systems that were tested and what's actually in the end users' hands in California. And, although, we would really like to get that information, you know, not being in the industry, we don't have the specifics of what's in California, but we did do extensive market research to identify common configurations for all of the systems that were tested. And so we felt they're fairly representative at a national industry-wide level.

I think the second point relates to some of the way that testing is being conducted. And I apologize if we, you know, didn't make all of this clear in the report. We would have probably had a million footnotes as far as all of the steps that you need to go through prior to measuring the idle power of a system that aren't spelled out in explicit detail in the test procedures today. So maybe that's a conversation that needs to be had. But this idea of clean installing the OEM software -- or clean installing the operating systems, yeah, clearly after that is done, the system needs to have time to continue to receive software updates, new drivers need to be reinstalled that were present in the original OEM install. And so that is something that is a part of our analysis, and I just wanted to recognize that, that those steps are being taken when these measurements are done.

There were -- I think there may also be a little bit of a misconception that the systems that we generated through component swapping are somehow low performance. And I just wanted to clarify that, you know, particularly on the processor end, we did not use mobile on desktop or, otherwise, notebook components in our desktop system builds. And so those components were actually kept at a similar performance level per the Energy Star established categories, and we actually did some benchmarking to ensure -- with commercial benchmarking software that the system performance didn't degrade. And, actually, in a few cases, the performance went up with the more efficient part replacements.

And, finally, I think the last technical point I just wanted to address was this idea of rightsizing power supplies. And I think it was presented that, you know, the IOU discussion of rightsizing is a strategy that could be applied to anyone in creating any computer, and that's not the case. And, actually, I'm just going to -- verbatim from the report, actually, the way that we tried to characterize this is really as one pathway to achieve improved efficiency. So it's a promising design strategy, but it's not appropriate in all situations and, you know, for example, expandability, we realize is a concern. And so that's -- we need to make sure that these strategies are applied and don't compromise the OEM's overall design objectives.

So that's all I just wanted to clear up. Thank you.

MR. RIDER: Thanks.

I have multiple cards from Southern California Edison. Is there -- no? Okay. Well, if you still want to speak, there will be an opportunity in a moment.

We've got Stephen Eastman from Intel.

MR. EASTMAN: Hello. So I'm Stephen. I thank you for the time here, and I appreciate the opportunity to come and talk to you guys.

First off, I want to thank you, Ken, for saying that the graphics cards, you didn't put them in the proposal but you still think that there still should be some. Because even like -- everybody in industry and energy see -- even show that there should be adders for graphics cards. Everybody's data (indiscernible). So thank for you that.

A few other technical points, to comment on some of the previous -- other presentations here, just to kind of point them out. In the Consumer Federation of America presentation, on some of those slides, they didn't show -- he tried to show that the computers' industry power has gone up over time. He compared computers in the year 2000 to the year 2010. So year 2000 was right around Pentium 3, Pentium 4 time frame for computers. I don't have data in my lab based on that, so I went online and found data in the past day, around 86 watts was the idle for a Pentium 4 computer. If you look at nowadays' computers, we're in the 20s for idle. So, definitely, our -- the industry of the power -- or the power consumed by the industry has dropped dramatically. And this is very different than the -- well, his data showed TEC. I don't know what calculation he used. I'm talking power, so it might be slightly different. But that's -- at least the power has dropped significantly.

One other question I do want to talk about is the Aggios demo over here. And, again, comparing that to the CEC report, so the CEC report said on desktops that it's only a $2 cost adder. If you look at the power supply itself, it's an -- I looked it up on Newegg here when we were sitting in the meeting, it's $115 on Newegg. If you could buy a comparable power supply, 400 watts, from Sea Sonic, same vendor, 80 PLUS Bronze, it's $47. That's a huge cost adder. That's not $2. That's, you know, $60, $70 something or right there.

The other question on the DC-to-DC converter that they're using over there, I have not tested one of those in my lab, but I could definitely take one of those if you want me to. The industry, as Intel and other industry vendors, we have a very stringent power supply requirement, that power supplies have to meet something around 250, 300 lines of code that we run power supplies through to meet it. It's not just a simple, does the thing power on. So my question is, is does that power supply, the DC-to-DC converter that you're using, does it meet all the industry standards for what a power supply needs to meet to make a computer work for the life of the computer? So that's one question I would have about that DC-to-DC converter there.

Let's see here. And I think that was all of my points.

So, thank you, for your time.

MR. RIDER: And just -- I think maybe we'll talk or have someone from Aggios talk about the PSU, but just to address the first demo, I think the key there is more the delta that's achieved. So the PSU was not swapped out during the demo, and the point is -- at least what I took from it -- was that the delta that was achieved without changing any of the parts live and the PSU wasn't what enabled that delta, it was the software settings. So I understand what you're saying. It's kind of expensive power supply. Which -- that's where we started at, right, though. And so the -- at least what I took away from it was that the delta is what they were trying to demonstrate, that you can reduce a significant amount of power by tweaking the same machine without doing any hardware changes.

MR. EASTMAN: In the quick demo that he showed you, we didn't let the thing go to the end, we didn't see his final numbers, but if you run the short idle, which is display on at 22 watts is what we saw with him, his computer, and then we saw it go down to 16, 17 watts. If you run the TEC calculation, that's 90. That's way different than the 50 proposed by CEC.

MR. RIDER: Sure. I understand. Thank you.

And then I don't know if you wanted to --

MR. ZIVOJNOVIC: (Indiscernible).

MR. RIDER: Yeah. Yeah. Please.

MR. ZIVOJNOVIC: Thank you for the comments.

Obviously, the piece, the picoPSU, was fixed as a piece resembling what is typically found in your notebook type of devices, (indiscernible) box devices and so on. So let's look at the little bit bigger picture.

The ATX standard and the whole power supply in these boxes is very, very old. And when compared with what we see typically in the normal industry, it needs a refresh. This particular picoPSU is the part which people who have a car and would like to run a computer in the car use, because it really converts 12 volts to a set of other voltages needed to run a PC like this.

So I would not suggest anybody to just start replacing all their PSUs with this device. This is just a hint where the potential is. And probably the right address to look further is how the (indiscernible) boxes are supplied. How your notebooks are supplied. And they have very similar requirements from that perspective. And it's actually a two-stage power supply; 110 to 12, and then 12 to the voltages you need for the board.

So maybe in that space is -- are elements for innovation and improvement in the industry.

MR. RIDER: Sure. Thanks for responding to that.

Folks in the room, in general -- Mark, if you would like to come up.

MR. COOPER: (Indiscernible) a couple -- three points.

One, the graph is labeled "household consumption," so it's not individual devices.

UNIDENTIFIED MALE SPEAKER: The start-up draft, I thought said per device.

MR. COOPER: No. It's not --

UNIDENTIFIED MALE SPEAKER: The second (indiscernible) -- you had number of devices in the right-hand side, I thought said per device.

MR. COOPER: I think that's use, not energy consumption. Of course, I was looking at the total number of kilowatt hours, which is the number of devices times the amount of usage.

UNIDENTIFIED MALE SPEAKER: Maybe it was --

MR. COOPER: It's not -- it's not -- it's not -- it's hours per device, not energy, first point.

Second point, having participated in 400 regulatory proceeding at the state level, the data issue is a perennial problem. The industry has the data, they won't give it to the Commission, when the Commission does its thing, then the industry says, aha, you didn't use the right data.

The way we deal with that in litigated

proceedings, quasi-judicial proceedings, is you got to put your data in subject to cross-examination. And then everybody gets to put their data in, and let's have a litigated proceeding. And I would love to cross-examine folks on their data.

But this game we've gotten here in these regulatory proceedings of not showing the data, you know, exactly what you sell, you've proven it to that, and the fellow from Dell said he would never show this, but here was a reason he had to show it. Well, give the data to the Commission. We'll subject it to confidentiality, and let's exam it. You've got the best data. Stop saying -- playing "I gotcha" when the Commission doesn't match your data. You got the data. We know it.

Third point, and it really does strike me, it came up a lot, the question of one-size-fits-all. I have not talked to anybody at the Commission, I may get lynched for saying this, but attribute-based standards are the current auto standard. They are an immense improvement, and it's something that I think is worth thinking about. And I have no idea why you didn't do it or what you could do, but it is an important point, and it may be at least one area where there's a significant compromise and movement possible.

MR. RIDER: Yeah, sure. And that can be part of the discussion. And I think maybe it makes sense for me to expound a little bit more on how we kind of arrived at a one-level standard. And we got there from -- you know, I was the author on this report -- started by looking at what the high-end computers would need to consume. So I started looking at the highest end processors, maybe not the extreme level of like Intel's level that really, you know, really expensive $1,500 processors, but you know, even like the high end $300, $500 processors, what are they doing when a computer enters idle. Because the current differentiation in Energy Star is based on two things: Whether there's a graphics card in or out of the computer, and, also, the P score, which is completely based on the processor. It's the frequency of the processor multiplied by the number of cores.

So I started at the high end, and I look at what's going on in idle. And these high-end processors, the newest generation, are idling down at what I presented in my presentation levels, around 1 watt, 1 and a half, getting into C-7, C-6 states. And there's even further states beyond that that these processors are capable of.

Now, at that point, you're already at 1 watt. How much more energy can you shave going to lower performing processors? So if I'm already at this really efficient level at the high end and then I'm trying to scale that toward lower consumption on the low end by something that is already -- there's not any energy to shave off, that was it. So I stopped there. High performance can meet 1 watt or 1 and a half watts by the data sheets and things that I've seen from industry. And so that's why I stopped, decided not to differentiate, because the high end was already at a low consumption. And so it didn't make sense for me differentiate, because there was no additional energy to squeeze out of the processor.

So -- and then on the graphics card, the graphics adder, I've already discussed that we should probably look at doing something on that one.

So -- but that's why that disappeared.

And then on the laptop side, it's also for a little bit different of a reason, which is the number of kilowatt hours you squeeze out of differentiating from a lower amount. If you look at the Energy Star, has those six categories as presented, but they're really 1 kilowatt hour different from each other. So you spend all this time differentiating six product classes over 1 kilowatt hour. Instead, again, took a high-end approach, just said, all right, let's flatten this out, because previous levels have been pretty different, but this Energy Star level, particularly for laptops, is flat. And you can see that trend in the graphics card demo -- data that I think Pierre -- or maybe the IOUs put up -- is the idle level is becoming flat across performance. And so the trends in the industry is that idle is just kind of one level, and it's not really varying a whole lot by performance.

And so that's what I saw. We're certainly going to take a lot more time to discuss it. But that's kind of the thought process that led to a flat level, not that we were just trying to clump everything into one, but that the data that we saw and the industry trends in processors and devices were showing that trend already.

Okay. Yeah. Why don't we start with you, Gary. Please use the mic, because we are trying to get a transcript out of this.

MR. SAXTON: Sorry to interrupt. Just before you do, I want to go back to Mr. Cooper's second point, on data. Yes, it's a perennial problem. I'd like to reiterate, again, as we've done at every meeting, with every proceeding, we do have a confidentiality procedure here at the Energy Commission. The attorney on this proceeding, Jared Babula, had been sitting next to the podium all morning. He's stepped out now. He can give you the details. Data can be submitted to the Energy Commission confidentiality.

Thanks.

MR. RIDER: Great points.

MR. VERDUN: So a couple of notes.

In the response and other things, since I've talked to -- a lot of people have talked about the ability to hit the power levels. And I've never disputed that we can hit those power levels. The question is whether or not it's actually cost effective.

When we design a system, we have to consider performance requirements of the end user, other functional requirements of the end user, cost and power consumption.

MR. RIDER: Can you tell me your name?

MR. VERDUN: Gary Verdun with Dell. Yeah.

So if you look at any one of those vectors by itself, you can get a completely different answer than what's -- then what could possibly be built and shipped to the end user. We go back to the automobile analogy. The automobile analogy says, if you took every wheeled vehicle with an internal combustion engine and made them consume in park or idle or neutral, you know, the lowest thing you can find, that makes everyone have an engine of a moped. And, although, yes, you can have automobiles that do certain things well, you have a real hard time running a truck, a dump truck, transportation vehicles, 18 wheelers. They can't run on those engines. And so that's our whole performance thing is, because work is completely unconsidered in all of this, the effect on work and ability of the product to do the useful work that customers require is completely out of the question.

And if you take that single vector of idle power and run it to the absolute lowest, you will affect performance.

There was a discussion about tablets, notebooks, desktops, integrated desktops. A big part of the power delta as you go up those is the bigger displays. When I look at a phone or tablet, I have a display that consumes a couple of watts to provide the image. I can hit that power level on an integrated desktop or a desktop as long as you don't care to look at the screen, but if you want to look at the screen, I need somewhere around 4 to 8 times the power to make this big of screen give you enough brightness to read it compared to this big of screen. So there are some physics limitations that are completely unconsidered in that.

And, again, none of those are energy efficiency, they're average energy consumption. If you really want to talk efficiency, you have to look at the work. And this regulation, again, completely ignores any type of work capability.

Very passionate about that because my customers insist on it.

DDR4, keystroke sleep. Every notebook shipped right now from Dell -- and I can tell you every desktop shipped from Dell, particularly business products -- turn the processor into its lowest power state hundreds of times a second. Milliseconds is so long it's ridiculous. The average on time for a processor in idle is 10 microseconds. Comes on for 10 microseconds, does its background activities, and gets turned off. It gets put into C-6 -- well, C-5, C-6, C-7, depending on how long it's been doing it. That exists today in notebooks. It happens in everybody's notebooks. It happens in desktops now.

And so you can't assume that we will make significant gains by turning that on. It's already on. It's there.

Yeah. I don't remember too many other shots with (indiscernible), but those are the ones that mattered.

MR. RIDER: Sure. And I just want to --

MR. VERDUN: Thanks for your time. I appreciate it.

MR. RIDER: -- make clear to you that there is a display adder for both integrated desktops and laptops and it does, I believe, scale to the size of --

MR. VERDUN: I'm just disputing the point that the entire computer industry can be served by a phone or a tablet.

MR. RIDER: Oh, okay.

MR. VERDUN: All right.

MR. RIDER: Sure.

MR. VERDUN: And that all products can meet the same power level as a tablet.

MR. RIDER: Okay. I misinterpreted --

MR. VERDUN: You can do that as long as all you want to do is whatever you do with a tablet. If you want to do more and you want a bigger screen, we need more energy to do it. And that's completely undisputed.

MR. RIDER: I misinterpreted. Now I understand your point.

MR. VERDUN: I think that -- well, we can get into a lot more detail and -- well, we'll have a technical day. We need to get into a lot more detail.

MR. RIDER: Sure. Sure. Sounds good.

MR. VERDUN: There's a lot of physics. And then the whole processor thing and whatever, so I did the processor enhancements and P- and C-state enhancements at Dell. I know what it is. I know how it works. I helped Microsoft and Intel create them. So I know more than anybody around here on that, most definitely. So --

MR. RIDER: Look forward to continuing to talk to you and figure out what that gap is there.

MR. VERDUN: Thank you for your time.

MR. RIDER: Go ahead -- no, if you -- okay.

MR. COOPER: I want to understand this difference because it's -- so Ken says he studied the high-end processors and discovered that when they were in idle, no work, they were down to 1 watt. And he said to himself, Okay, well, why can't the other processors do that as a standard? And your answer is, It cost money. And I can't -- I'm spending money to have it perform that way. So there's no doubt it can do the work. It can re-power up. And why can't that happen at the lower end. Your answer is that, I don't design it that way and it would cost me a lot more money.

MR. VERDUN: I never said that.

MR. COOPER: Well, it cost money.

MR. VERDUN: Don't put words in my mouth, now.

MR. COOPER: No, it cost money to do --

THE REPORTER: Sir, can you speak into the microphone, please. We're not (indiscernible) this for the transcript.

MR. COOPER: No. No. But his answer was --

MR. RIDER: Well, let's --

UNIDENTIFIED MALE SPEAKER: Folks -- folks --

MR. RIDER: Mark, can you speak into the microphone, please?

MR. COOPER: Okay. But the point is that his answer was it's down to 1 watt in the idle, so why can't the other processors do that.

MR. VERDUN: They do.

MR. RIDER: Well, then, so it doesn't make sense to scale the -- and then my conclusion is, it doesn't make sense to scale the standard by a processor power, the frequency multiplied by the cores. If they are going down low, then it doesn't make sense to make that --

MR. EASTMAN: But my point to that is, when it happened with Energy Star and why it went that way and why that proposal worked and the industry, you know, backed it, and the industry and the EPA worked back and forth on that proposal, was, how else do you explain that when you look at the high-end performance processor versus and use the Intel line from a Core i7 down to an Atom processor, yes, they all get down to very low watts, in the range of 0 to 2 to 3 watts. They're all down there in that range. But when you buy a Core i7 processor, you're expecting performance in other components in the system will be consuming more power, there will be other components that go along with that Core i7, because you don't put a Core i7 in a tablet.

So there's other stuff around it, and the only way to bound it was to say that the processor was the consistent factors, when you have a more higher performance processor, you get more other components that can add up to extra power. So that was the reason behind that worked.

I agree, yes, when you look at just

processor power, it does not -- it's pretty consistent across the range. But when you add the extra components of what a performance computer needs, then it makes it up. So that's where we got that. That's where it came from.

MR. RIDER: Thank you.

UNIDENTIFIED FEMALE SPEAKER: (Indiscernible).

MR. RIDER: Yeah, I would like to be a little more organized like that. So, actually, I really like this idea, so if you could just go ahead and line up if you plan to speak. It's a lot easier than trying to pick who is -- and less personal that way for me. Okay.

MR. KIM: Thank you very much.

I'm Charles Kim of Southern California Edison Company. I would like to take a moment to recognize and commend the staff. This computer topic is not an ordinary topic. It requires and demands extraordinary efforts, not just understanding the market trend and testing methodologies, but the understanding of the ins and outs of a computer at the component level.

Staff's extraordinary effort certainly

demonstrate CEC's, therefore California's, leadership in energy efficiency. Mr. Hankins [sic] of ITI mentioned the IT Revolution. Yes, it started in California, and I'm very proud of it. And the same revolution for energy efficiency can start in this California State as well. But it doesn't require new knowledge. Off-the-shelf technology is available, and they are cost effective. And I look forward to work with the many stakeholders to (indiscernible) the proposed rulemaking on this particular proceeding.

But I just want to make one more, that is, this is not an ordinary topic, as you can see. And I continue to expect extraordinary effort from the staff to lead this topic. And I'm very thankful and very grateful for his leadership, and we'll continue to support him to meet the California goals to protect our environment and also reaching the greenhouse gas reduction goals. Let's work together. And I'm certain that we can reach the sensible and cost effective and technological feasible solution by working together.

Thank you very much.

MR. RIDER: Thanks.

Go ahead, Pierre.

MR. DELFORGE: Pierre Delforge, NRDC.

I'm apologizing and taken back in the weeds after Charles' comments. But I want to kind of respond to a couple of points that were made.

Mark, you know, you suggested a performance-based approach. And, you know, we fully support performance-based standards, but, in this case, the test method is measuring computers when they're not doing any work. So the question is how much performance do you need when you're not doing anything. And we're not asking to downsize the engine. You know, you can have the engine you need. You can have a Ferrari engine. You can have a Tesla engine, whatever. But when you're not using it, when you're not going anywhere, you don't need the engine on. And that's the thing, that's our whole point.

As long as you can wake up without latency, as long as, you know, you can perform all the work that is demonstrated on the benchmark, power managing the computer when you don't work on it, when it is not doing anything, doesn't impact performance.

This is true for graphics as well. Yes, graphics are going lower as, you know, I think Nate early on mentioned, they still need some power in idle. But why? I mean, why do we need power in idle when we have hybrid graphics technology that allows you to switch to integrated graphics. I know it's not in all computers today. And that's the question. The question is, can it be within two years? You know, that's what we need to talk about, not whether it was done five years ago even if it's deployed today at scale. No. Is it technically feasible? Is it cost effective? Can we do it within two years?

So that's a conversation I think we need to have if we don't want to talk past each other in the stakeholder workshops. How can we make it happen? Is it technically feasible? And, if not for really good reasons, then, you know, let's look at what can be done. And maybe in that case we need performance categories and adders. But not if we don't.

And with storage, the same thing. Why do you need a second storage disk in idle to be on?

I mean, it doesn't have to be on in idle. You can have as many additional discs that you need, but they don't need to be on when you don't access -- when you're not accessing the data. So, you know, why do we even need a storage adder?

So that's the thing, that's the conversation I think we need to have to move forward on, you know, whether we have a standard that's effective and at the same time meets the market needs.

Thank you.

MR. RIDER: Shahid.

MR. SHEIKH: This is Shahid Sheikh from Intel.

Just to go back on the categorization. And, Ken, you mentioned that, okay, the CPU, you know, idle power has gone down, and so there's no way to differentiate higher-end CPUs from the lower end in that range. So within Energy Star, the history, and I've been involved deeply in that, was that we had to find a proxy to be able to separate categories. And so looking at just the attributes of the system level was not cutting it anymore, from going to Energy Star

Version 5 to Version 6. So the proxy that was close enough, it's not perfect, you know, again, we're looking at real systems, and we're not going to achieve perfection. The best proxy was looking at, okay, CPU, TDP power and a number of cores and frequency.

And so that served as a proxy because the type of components in the platforms at a higher end of those performance score would tend to be the ones that will also be higher power.

Okay, now is that always the case? Most cases, most times, it was the case. So that's where the whole proxy for category separation came into place.

Now, if you feel that that proxy for the way you want to separate a category is not good enough and you have -- we have a different way to look at it, that's great. But let's not kill the categorization just because we don't like the proxy of CPU frequency times the core anymore. Let's look at finding a different way to look at it. Because we can't compare high-end products with the low-end products and based on the attributes.

Thank you.

MR. RIDER: Very noted. And, you know, I'm not saying that we absolutely would not do a categorization. Just like the graphics adder, what we saw in Energy Star just didn't make sense anymore for where the industry is headed. From all the data, from all the performance, the adders for the graphic cards didn't make sense anymore. The categorization, things are changing. I've reviewed all the roadmaps from the industry from AMD, from Intel, looking at what's going on and where is memory going, where is everything going, and it's all -- you know, flat is what I'm seeing. But what you guys have more experience on, particularly, and where the discussion is fruitful and -- is where that's not true and where the power consumption is not going to be able to get to that flat level. And it's not around the CPU, and it's around -- at least from what I have seen -- it's around something else, other parts, other things --

MR. SHEIKH: Yeah, (indiscernible) platform.

MR. RIDER: We've got adders. We've got at categories. I mean, adders is one -- one approach that's being used here to deal with that. But categorization is another approach as well. We just need to characterize what that is, because I don't want to make it -- I want to be specific to that need and not around something that doesn't make sense, like the cores, the number of cores in a processor.

MR. SHEIKH: And looking at component level is fine, but I think for this regulation, we got to look at the system level. Just because some of the components' power is going down, but the rest of the system may not be going at the same clip -- right? -- so you have to look at what differentiates idle power at those systems, the high-end systems versus the low-end systems. Why is there a need for higher power? Because they have to get to work quickly and their performance requirements are much higher for those high (indiscernible) systems.

MR. RIDER: Thanks, Shahid.

Gary.

MR. VERDUN: So I guess one of the biggest things I want to comment, that I guess our real issue really is not so much the 50 kilowatt hour limit number. I think it's really more the time frame. So you look at what we've done in PCs, we've -- without any regulation, as I said earlier -- cut 80 percent our annual energy consumption and had almost 3X the performance in the products. That trend will continue.

One of the problems I see, particularly from a desktop standpoint is, if we get limits established and we know what our design target is, and we don't know that until next year, the products that are going to be in the market in California that have to meet that limit, already done. They're designed. So I don't have time -- if I have to change silicon -- people talk about these features exist in other products. Yes, those are silicon features. If I have to add those features to the components I use in my desktops, it's going to take me three to four years. Eighteen months is a typical spin on a piece of silicon. And then I have to design a product with that silicon after it's made and qualified.

So, to a large extent, we either have a combination timing and limit problem, or just a timing problem. Because those features that enable those things do roll on in the desktops, but it takes time. And the i7 scenario -- analysis you did is, yes, that's true for Intel's latest i7. I think it costs a little bit more than a mainstream processor.

So process technology changes and design changes on processors, chipsets, and every piece of silicon that goes in a box over time, make improvements. But mainstream and, you know, bleeding edge have a different -- very huge difference in price point. The Dell Latitude that was up here compared to the MacBook Air, that's fine and dandy; yes, the MacBook is less. It's also about $600 more. And I can go do an analysis on the energy consumption delta between them, and I can tell you that the cost of the system, although it's achievable, it is a lot more than the energy savings on that product. Because a notebook has power management, it's going to work. And a notebook energy cost is about $4 a year.

And I keep asking -- customers tell us that they're willing to pay for any energy reduction we do in our products as long as they get a one-year payback. We kind of pushed that to the three-year life of the product. But once you go beyond that, they don't want it, because they're spending more money than they save on their energy. I mean, it's their business, guys. Go do a TCO on the product. And so that's what drives what we do, to a large extent.

Many of the products looked at here that were used to determine possible reductions -- and I agree, very low efficient power supplies, yes, those exist in low-end products that are purely cost conscious, where the only thing that matters is the price point to the end users. We can fix them. A lot of those guys will get a positive return, but the price points will go up.

A typical minimum performance regulation, like the CEC is trying to do here, is the kind of thing done in the EU. And they historically go take the bottom percentage of bad users and remove them, and over time, you move up the level. But I just believe that it is completely unrealistic to go set that at -- you know, 90 percent of the market won't be there.

Then, again, just back to the thing, the whole timing thing. So the levers we have to pull in the time frame here for a product that I have to have in production before the end of 2017 gives me less than two years that those products are definition. So other than selecting a few different parts and minor changes in the motherboard, I can't make it. And that's why my analysis did, you know, the more expensive hard drives, mobile chipsets, because I don't have time to fix fundamental problems in my -- in my desktop parts in that time frame.

So if I can't do it otherwise -- and, again, we're back the performance requirements of my customer at a cost point -- all I can do is pick mobile parts.

So we talked about the automobile industry in 15 years. Give us 15 years, and we'll be one-third of what you're proposing now. Give me two years, I can only make marginal improvements. And that's just the facts. I mean, I can't create things that don't exist.

Thank you.

MR. RIDER: Thanks for the comments. Thanks.

MR. COOPER: I don't want to prolong this, but in the interest of -- the redesign and refresh cycle is critical. And if you look at that automobile standard, they went out three cycles to make it happen. And that was a big change.

But the quid pro quo for giving you more lead time is also maybe thinning them out another cycle.

So you tell me you're going to go there, I just want to make sure you go there. So that is something to talk about.

Second of all, just a payback, I have a simple consumer pocketbook rule. Your industry guys want a one-year payback and you push them out to three, I'm actually in the middle of that. I want the payback half of the product life. The simple rule that I -- I want to guess low -- positive I can get it, but I don't usually get it -- half of the product life. And if you look at these, that's about what they had there, so --

MR. RIDER: Thanks.

If there's no one else in the room, I'm going to -- I think there are a few folks on the phone that would like to speak. So I'm -- I know a couple already, but if you are on the phone and you would like to speak, go ahead. And if you're WebEx, raise your hand, use the raise-the-hand feature, and -- or shoot me a comment and I will unmute you.

I believe Andrew deLaski wanted to speak, so I'm going ahead and unmute him.

Andrew, you're unmuted. Feel free to speak.

MR. DELASKI: Thanks, Ken. Can you hear me?

MR. RIDER: Yes.

MR. DELASKI: I'll be brief because a lot has already been said and I know people are eager for lunch there.

I just want to -- this is Andrew deLaski from the Appliance Standards Awareness Project.

I want to generally express my support for the direction the CEC has proposed. There are a couple of features about the proposal that I want to highlight that I think are particularly important.

One is that CEC has proposed a -- the staff report had included a performance standard, and the fundamental characteristic here is that it leaves the industry a lot of flexibility. And that's what I've heard a lot today from industry, is the desire to have the flexibility to comply in the most cost effective way that it can. And that's a fundamental benefit of a performance standard as a general approach. It allows compliance at the lowest cost. And I think the prior commenter said, that lower cost may take time to come into play. But that's one of the key characteristics and benefits of using a performance standard. That has been included, for the most part, in the staff report.

I also want to reiterate and comment on the focus on the idle mode. This, also, by emphasizing and focusing on when the part is at rest, it provides the flexibility for the products to do more when they're at work. I've heard the industry points being made that there is some scaling with respect to idle mode, but that seems like a factual issue that needs to be further assessed out as folks continue their -- continue the dialogue.

I also want to echo the comments of the IOUs and NRDC with respect to technical feasibility. I think there's been a lot of good work done here. And what I'm hearing back from industry also is that they're not disputing -- I don't hear a lot of disputing on the technical feasibility, and it seems like the conversation today has turned more to the question of cost and timing. And that brings us back to the issue of collaboration and sharing of data. I think I heard earlier Advisor Saxton, you know, point out the opportunity for NDAs. And I would encourage the folks from industry to develop NDAs with the CEC to allow the sharing of cost data so that Ken and the team there has confidential data that they can use to better evaluate the cost to meet particular standard levels.

And, again, as has been pointed out, the folks from industry are the ones who have the better grip on that, but until you're willing to put it into the hands of the CEC staff under the protection of an NDA, they're not going to be able to benefit from it.

I also want to echo the comments that Mark Cooper made about the need for standards here. And I think I hear a general consensus that it's clear that the potential for standards to make a contribution to meaningful energy savings and energy efficient improvement, is substantial here. There's been tremendous improvement over the years, as has been shown. But there's potential for more improvement. And as Mark Cooper described, the consumption -- the energy consumption of the computer is not front-of-mind for most consumers when they're buying a computer. And the role for standards to -- as a public policy tool to drive savings is quite important for what -- a big energy use.

And then I just want to close by thanking everyone who has participated today, and we look forward to being engaged in this docket going forward. The, I think the industry, in particular, has also offered a lot of very thoughtful presentations early on and expressed a willingness to engage here and to collaborate to find a way forward that meets the needs for consumers and does it in a way that keeps costs at a point that's going to pay back for consumers. I think there is an opportunity for good collaboration going forward, and I welcome the opportunity to participate in the workshop that has been proposed for later this spring.

Thanks a lot.

MR. RIDER: Thanks, Andrew.

I don't see anyone else's hand raised here on the phone, so I'm just going to briefly unmute some of these call-in users because they don't have the ability to raise their hands, and then we'll move on to lunch.

So let's see here. So I'm unmuting you. If you've just called in and you haven't -- you're not on the WebEx, if you would like to speak, go ahead.

(No audible response.)

MR. RIDER: Okay. Don't hear any.

Last chance for anyone in the room.

(No audible response.)

MR. RIDER: All right. Well, in that case, we'll go ahead and break for lunch, get some food in our stomachs, recharge. One-hour break for that. And I guess we'll be back at -- you want to cut it down a little bit? Maybe 40 minutes?

UNIDENTIFIED MALE SPEAKER: No. Let's do it one hour and start at 3 o'clock.

UNIDENTIFIED MALE SPEAKER: Start a 3:00.

MR. RIDER: Okay. One hour. We'll see you at 3:00, and we'll continue this on displays.

Thank you.

(Off the record at 1:53 p.m.)

(On the record at 3:05 p.m.)

MR. SINGH: Hello. My name is Harinder

Singh. I work -- I'm an Electrical Engineer for the Appliance and Existing Buildings Office. I'm presenting computer monitor displays and signage displays.

So I'll go through this slide, as, you know, the purpose of workshop, I think we are already into it.

So I'll go directly into the scope of the proposed regs that are in the staff report. The scope of the proposed regulation includes residential and commercial computer monitors of all sizes and signage displays that are of the size greater than 12 inches and pixel density of greater than 5,000 pixels per scale range. So this is the scope.

And we have taken the definitions from Energy Star Version 6.0, and we have definition of electronic displays; enhanced performance display; and display on mode, off mode; signage display, which is, you know, we are adding to the existing television definitions; and then display sleep mode.

And, also, the best methods for the televisions is the -- for the display, signage displays, is the television test procedures, which is already in the existing CFR, Court of Federal Regulations. And that is going to be for the signage displays.

And the test method for the computer monitors is the Energy Star test method for determining the display energy. We use, again, the Energy Star Version 6.0.

These are the State's standards for non-federally regulated appliances. And this is the Section 605.3. And we are proposing these levels for the display monitoring -- for the computer monitors.

And my next slide is about the existing standards that -- television standards that we have. And what we are doing here is clarifying the definition to -- because some of the display -- signage display manufacturers are complying with the current television standard, while some of them, there was some confusion there. So we are clarifying and making sure that all signage display manufacturers comply with the existing television regulations. And this is the table and the standard, on-mode standard, they have to meet, as well as the standby and the power factor requirements.

So we -- this slide is about the comparisons, where we are in terms of Energy Star's Version 6.0 and Version 7.0. And so the blue line shows the CEC display -- proposed display monitoring -- computer monitors and the display standards, where the energy levels are going to be. So I just wanted to mention that here so that there is a comparison of the data there from the Energy Star, as well as our proposed standards.

Computer monitor shipments. We find that the computer monitor market distribution by screen size is -- would be -- 21 to 24 inches is where the major market is. And it's -- almost 60 percent of the market is in those two sizes, and the rest of the market is -- 40 percent are the smaller, and also 25 to 27 inches monitors are.

And we see that, in 2012, when we look at the older data there, most of the computer monitors were LEDs, but, you know, there was -- 86 percent were LEDs, and 92 percent of the signage displays were LEDs. But, now, almost 100 percent are shipped, monitors and signage displays, are -- have LEDs light, backlights. So they've become very efficient.

And there's -- this slide shows that there is a decline in number of -- small size monitors are declining, whereas, there is a little bit of increase in the larger-size computer monitors market there.

And this one shows, overall, there is a decline in the computer monitor sales and -- on the consumer side, and the previous slide was the residential monitors. So there's, overall, a little bit of decline in computer monitor sales. But the sales of the larger sizes, a little bit up, whereas, the small sizes is going down.

And we estimate the computer stock for California for residential -- it's about 12.68 -- 687 million monitors for the residential, and commercial is 8.474 million. So the total stock, we estimate, is 21.1 million computer monitors in California. And this data is collected based on the Fraunhofer report. For the residential stock, we have taken from the 2014 Fraunhofer's study. And the commercial computer monitors stock is based on the 2009 Navigant study.

And we also have taken the duty cycle, we look at different studies, and -- and the residential annual duty cycle, we took it from 4 and a half for 2014 study. And also the commercial computer monitors duty cycle, we have extracted from the Navigant study of 2009.

So we find that, you know, the energy consumption of the computer monitors, the ones which are noncompliant with the proposed standard, is about 60 kilowatt hours a year. And the ones that meet the standard are -- consume about 32 or 33 kilowatt hours a year.

So there is a significant increase in power consumption if -- you know, with the proposed standards.

So the lifecycle cost and per-unit savings, we estimate the -- it's going to be incremental costs, it's going to be about $5, and the energy savings over a six-year lifecycle, it will be around $5 or $6 a year, $4 to $5 a year, so the total estimated savings over the lifetime is $26.54. And the lifecycle savings approximately $21.54. So there's a significant energy savings in this measure.

So the statewide energy savings we have calculated to be 585 gigawatt hours a year. And that equates to $457 million over the -- when all the existing stock is replaced. And the first-year savings will be around $15.93 million a year, first-year savings.

Technical feasibility of these computer monitors. There are already some measures that can be applied to meet the standard. Number one is the backlight unit, which is -- the average computer monitor consumes 40 to 60 percent of power in backlight units. So improving the backlight unit, the lamp efficacy, by using efficient LEDs or more efficacious LEDs, would produce the -- would lead to less power consumption and improving the LED efficiency from 110 lumens to 150 lumens would significantly improve the efficiency of the backlight unit.

We have looked at the data provided by IOUs and also NRDC and others, and find that there's going to be 8 to 30 percent energy savings with a moderate increase in cost when we use the efficient LEDs in the backlight unit.

And, then, there's, you know, the other factor is the LED crystal display transmissibility. The higher the panel transmittance, you know, by optimizing the pixel design and transmitters of the panel function layers can be improved by using color filter, polarizers, and reflective polarizing films. And these films can improve because of the reflectance, because most of the light produced by the backlight unit is -- goes to waste if you -- if there's no films. So 100 percent of the light can be recycled and reused from the backlight unit by using those polarizing and reflective films.

The other factor that can contribute to the efficiency of the units is use of efficient power supply. You know, using the 80 PLUS power supply and also the 88 percent if there's an EPS, you know, with the monitor, the new DOE standards also are set at 88 percent efficiency of the EPS. So those can be used to improve the efficiency of the power supplies. Again, the power supply efficiencies are very low, and replacing it, replacing the power supply, with the efficient power supply can -- you know, there's -- significant energy savings can be achieved. And, you know, it's easy to meet the standard.

And, also, the USB power monitors, if the video and power are fed over one single USB, it will save energy also.

And then the fourth factor is the -- limiting the brightness by using the automatic brightness control. Also, setting up the default brightness 200 nits or less, depending on where the monitor is. And it can -- if the brightness is set up at 208, it results in a 15-percent reduction in power consumption with no increase in cost. And, also, reducing the default brightness by using automatic brightness control, you know, the ambient light sensor can be used to measure the light and adjust the levels. And, also, using the software to interpret the ambient light levels and translate them to a particular display brightness. And the -- also the ability of the display to dim the light manually or via automatic would save significant energy in the monitors.

Other pathways include use of quantum dot technologies. That is currently being offered by multiple suppliers and use off OLED lights, OLED monitors, they do not require backlight and light filters. So there are other technologies that are available.

So this slide is about the cost efficiency improvements over time. We have noticed that the cost of -- the incremental cost has gone down over -- from 2013 to, you know, the re-estimating in 2016. This is what the cost of improvement is going to be. It was around $10 to $12, now it's coming down to $5 or less.

That was for the 22-inch monitor screen. But the others also saw -- show the same improvement in the cost of -- incremental cost.

So computer monitor efficiency for the -- the incremental costs for the 27-inch is -- also have gone to less than $5.

And, now, I'm going to move to the signage displays. Digital signage displays are covered under the existing television standards. IOU's market survey shows that not all manufacturer have been compliant with the existing standards. So clarification to definition and harmonizing CEC's definition with industry-accepted definition, the exception is that there will be greater compliance with the existing standards

So, again, the signage display shipments are -- the sizes are -- 45 to 49 inches is the most common, and that's 39 percent of the share of the market there. So those are big. And also

50 to 59 is another 20 percent. So it's a huge energy consumption, and we don't know how many of these displays are compliant and how many of them are not. So clarification will add to the energy savings.

And these are, again, the digital signage, the specifications, also the sizes that are most commonly used, 32 to 55 inches. They're all over the place. The signage displays are at the airports, hospitals, and all these public places. So they're being, you know, extensively used and their usage has gone up.

Again, the market shows the size increases and the -- there is an increase in the number of units sold.

This is another bar graph that shows that the shipments are on the rise from 300 million to now they're 400-and-some million. I'm sorry 400,000.

So the annual shipments and the equipment lifetime of these is -- the lifetime of the displays is 7.5 years, 7 and a half years, and the estimated shipments are approximately 60- to 70,000 a year. And the California stock is around 450,000 in displays.

We have taken this duty cycle from our televisions when we did the television regulations, but these signage displays are on almost 24/7, but -- you know, in most places, but it's also -- we have looked at it and we come up with a -- 18 hours of full time and 6 hours of sleep time for these. So the total on hours a year is 65, 70, and they're in the sleep mode for 2,190 hours a year. So assuming they are 365 days in operation, which they are. And the energy consumption of the non-qualifying, or the ones which do not meet the standard, we estimate the unit energy consumption of these monitors -- these displays to be 1,174 hours from 4 kilowatt hours. And the qualifying are the ones that meet the standard, is 608 kilowatt hours a year. And this is a standard that we, you know, with the television -- calibrated with the television standard.

But we are looking into also -- because the stakeholders are proposing that we go more stringent on these displays. So we are going to receive some comments from the -- -- we are looking for the comments from the stakeholders to make sure that, you know, if this is the right level of standard or we need to make a more stringent standard for these displays.

I also want to mention, on the enhanced performance computer monitors, we have -- we are seeking comments on that. We have not decided what to do with it at this time, although we had a discussion and we -- we are looking for some more data, as well as the comments from the stakeholders, that those enhanced performance displays are covered. And we going to cover those under the -- the proposed regulations, but we'd like to hear from the stakeholders that -- what is the adder we need to have? So we would like to receive comments on that.

So, with that, if there's any comments or questions, or we can do it afterwards.

UNIDENTIFIED MALE SPEAKER: (Indiscernible).

MR. SINGH: Yes. And, also, I want to add to here also that we are open to the -- you know, any request for data. Whatever data we used, we have that and we can provide that. And we want the stakeholders -- if anybody wants to discuss that, we are open to it and would like to do that.

With that, I think move to the next one.
MR. RIDER: Yeah. Let's -- so we have a few presentations that were submitted on displays. Oh, shoot. Okay. Hold on.
MR. SINGH: You got distracted on that.
MR. RIDER: Just a minute, folks. Let me get this thing straightened out here.
(Pause.)
MR. RIDER: Do we have someone in the industry who can get this PDF thing straightened out? So if you're listening to us, Cisco WebEx -- I'm just kidding. Almost got it all straightened out. If we could just -- everyone just turn your head like this, and we'll be -- okay. That's good. All right.
MR. HOLLENBECK: All right. Thank you. Thanks for fixing that.
Okay. Mark Hollenbeck with HP again, representing industry through ITI and TechNet.
I'm going to be covering computer displays. And, again, focusing on customers that buy them and what we're seeing as far as an impact associated with what's been proposed to date. I will mention, I was just thinking about the data that Harinder just presented. It's

worth noting again that we really want to see the data that was underlying your analysis in the proposal so that we can better understand where you're coming from.

Okay. So I'm going to talk, again, hopefully, not too long, on customer -- customers: Their use profiles, display families -- they're certainly a lot of similarities to the computers that we covered earlier today because they're part of the system -- get into the impacts with what we're seeing, talk about the specific impacts associated with the modal limits, talk about sleep mode, talk a little bit about enhanced performance displays, and do a wrap-up.

So we've already talked about customers in general and with PCs. Here, we're simplifying it a little bit. You've got basically, you know, your home users on the left, business users in the center, and then professionals.

And starting at the left, we've got users that are using smaller displays, mobile displays, but that are still stand-alone displays. These displays are different by design, and are used mainly for accessing the Internet, basic productivity software, doing e-mail. Similar to the kind of display that you would see on a traditional notebook. These are certainly not equivalent in performance or even cost to a traditional larger desktop display.

Okay. And then talking a little bit about customers that are both in the home and office. These are what I would call traditional desktop displays, and they're used for the same types of activities we discussed earlier with desktops and notebooks. And if you're doing both at-home and in-business basic productivity activities, accessing the Internet as well, writing e-mail, getting -- managing documents, as well as graphics and videos. And, of course, home users -- hopefully, limited to home users -- watching movies on computers as well.

And when you start thinking about professional users of displays, this doesn't correlate exactly with, you know, what we were talking about as far as high -- high-end desktops, because this category includes displays that are used with the workstations. And some of them, the models that are marketed for use with workstations, fit into the enhanced performance display category, and they have a much higher level of performance that they offer, as well as the price point.

And so the activities that are performed with these kinds of displays really are clearly the basic office productivity type activity, but you also get into professional use. And you can see users -- we have some users that use our displays for doing creation of graphics, creation of animated movies. You have scientists that are using these displays, and even they're used in medicine. So the performance requirements for these professional displays, which includes enhanced performance displays, are quite difficult and substantially higher performance is required for these types of displays, and the cost reflects it as well.

And then the other category that I'm not going to talk about at length because, frankly, ***we need to tie out with more manufacturers that make signage products are used *** for a completely different application than a desktop computer would be used for. So we will give much more input on that with our written comments that we submit.

Okay. I am just going to jump into a summary of the impacts that we're seeing with what's been proposed to date. And it's good to hear that, with enhanced performance displays, the direction you're headed there, I mean, as far as I read this spec, if I had to -- excuse me for fiddling around with that -- if I had to implement the spec as it's drafted, to be honest with you, we didn't know if enhanced performance displays were going to be regulated the same way as what I would call a traditional desktop. And that would certainly be problematic. So this comment about significant risk to customers, we could probably ignore that, but it still exists from the standpoint that, if appropriate limits aren't set for enhanced performance displays, that would be very problematic. Regulators throughout the world have looked at enhanced performance displays, looked at the small market segment that they represent, looked at the uses, and concluded that it just didn't make sense to try and regulate enhanced performance displays. And that's consistent with what we've been saying all along.

Okay. So, now, let's talk about the

proposed on-mode limits that impact displays in general. Similar to the situation we saw with desktop PCs, the on-mode limits exceed even the exclusive Energy Star 6.0 display program limits. And the impact is not -- it's not the same depending upon the size of the display, and you'll see that in a couple of graphs here in a minute.

And really saying many displays are noncompliant with the proposed on limits, if you look at displays that are currently on the market, it's a bit of an understatement. It's very substantial in the smaller-sized displays, which is counterintuitive. We don't think that you intended to do that. I mean, that would be my impression.

At least 90 percent of the displays, the smaller displays in the 15 to 21-and-a-half-inch size, would not comply with the limits that have been proposed.

And then you move into the 23-inch displays and you've roughly at 50 percent that are noncompliant that are currently on the market.

Larger displays, and this is interesting, have a greater number of models that are compliant, at approximately 88 percent, which is counterintuitive because, you know, larger displays consume more power.

There's also some concerns about the sleep mode limits. And the problem with that is not so much the basic limit, but it's the fact that when displays are shipped with added features and functionality, they're not going to meet the 1 watt sleep limit -- sleep mode limit. And we don't know at this point if we can discount those added features or whether or not we have to account for those with a sleep mode limit.

But where we have additional functionality, such as the ones we have listed here, 1 watt is not sufficient.

So here's a chart that provides a little better look at the displays and accounts for the pass/fail rate in the different sizes. The one thing that you have to realize about this, and we've talked about problems with data, is that these charts were based on the Energy Star set of qualified projects. So these failure rates are going to be higher if you consider all displays that are on the market.

And, as I said earlier, if you look at the diagrams, the -- if you all just look at the one in the center, if you're looking -- depending on kind of where you put the range, if you're looking at, you know, 17 to 23 inches, you've got just under 50 percent that fail, at 47 percent. Moving down here for the really smaller ones, as I said earlier, you know, more than 90 percent of them failed the proposed on-mode limits. And then the other displays, you can see the results yourself.

Here's another way to look at the same type of data. Again, this is for Energy Star qualified displays only, it doesn't represent the whole market. And you can see -- it's a bit of an iChart, but you can see if you look here at this red line, if you can see that on the screen, I'm not sure you can, across the bottom, that represents the proposed on-mode limits that California had proposed. And, again, and just like we've been saying, smaller displays, you know, much higher percentage of compliance. Noncompliance, move into the mid-range. You know, you've got -- you know, in the 23-inch range, you have some that meet and some don't, roughly 50 percent. And then you go into your larger-size displays, and you have a substantially higher percentage that comply. And I just don't think that's what you intended to do. Maybe it is, but it's a question that ought to be given some thought.

And this is just some more discussion about the added features that need to be considered when setting sleep mode limits. You know, as I said, 1 watt in sleep mode is fine unless you're having to look at the power consumption of these added features.

Here, we're going to talk a little bit about enhanced performance displays. And, as I said earlier, you know, I'm glad to hear they're not going to be put into the same limits that traditional computer displays are put into. But we give just some of the features that an enhanced performance display offers. So you've got higher resolution, better viewing angles, enhanced color.

As I mentioned earlier, these displays are significantly higher in cost, but -- and there just aren't that many models sold, so a much lower volume. They're traditionally sold for people that are using high-end desktops and workstations where they're doing a lot more detailed graphical-type work. Examples include, you know, medical, engineering, graphics design, computer aided design, advanced three-dimensional modeling, et cetera. Three percent of the models would fit into this category that are Energy Star qualified.

And it's fairly obvious, or I hope it's becoming obvious, that with the added performance, you're also -- you're going to have higher -- slightly higher power consumption as well.

And then there's some connectivity and expansion often integrated into these products as well.

So you can just see, at the bottom, the graph representation as to just how small the market for enhanced performance displays is. And, as I mentioned earlier, most other regulators have realized that, with the volumes being so small and the need so critical, that it just didn't make sense to try to regulate these products.

So, as I mentioned when I first started, we really want to see your data. We'd like to get an idea of why you reached the conclusions that you did. And then, hopefully, we can come back and talk some more about that. I think the data will speak for itself. The data set for smaller displays, we were given some data on the smaller displays, and we're a little concerned about some of these assumptions behind that. And I think -- I had time to look at two examples that were provided, and they were USB-powered portable displays. Those products are not at all offering the same type of performance you would see with a traditional desktop. They're low resolution, and they're not going to be acceptable for use as a desktop display. And they're also limited in size. So it would be a mistake to take data for small USB-powered displays that provide low resolution in limited size and scale that up for use in setting limits on all displays.

So with current products that are on the market now, you're at roughly 90 percent of the computer displays on the market in the smaller 15 to 21-and-a-half inches. And that's 48 percent of the display market. And I know you're making some assumptions and projections about what can be done in the future, but this is a substantial percentage. And when Gary gets up next, he'll talk a little bit about some of the technical reasons why that doesn't make sense.

And, as I mentioned earlier at the beginning, this -- the limits that are being proposed here for displays are much more aggressive than Energy Star 6, and even the draft limits that are in Energy Star 7 for displays. And we believe that if this were to go forward as it is written, it would impact customers. So you need to also consider and work on the added allowances for additional features on sleep mode. And then, you know, I hope you'll at least consider, rather than just setting additional tolerance for enhanced performance displays, at least give some thought to, given the size of that market and the critical need for scientific, medical, et cetera, uses, that we hope you'd just consider excluding that from the scope of the regulation.

Thank you.

MR. VERDUN: Okay. So I was trying to

evaluate cost effectiveness and technical barriers. And I guess the first thing -- I've looked at the IOU studies that were provided to the CEC and I looked at the CEC response. And I don't see any data anywhere that shows how you get from one to the other one. So very limited in what I can say about the actual limits, other than how they affect existing systems and talk about some other features, but I can't comment directly on whatever the CEC done, because we don't know what it is.

I did a quick check, and they talked about things passing. So from a cost effectiveness sense, I can't actually do any real cost analysis on what was presented by them. We took the Energy Star database Qualified Products List, and I'll show in our thing later, but one thing we did as a quick check for cost effectiveness is I had a coworker who had some -- stole some time and they went and they took the 20-inch displays and they went and looked at the retail of price those that passed and those that failed.

The passing units were $20.50 on average, more expensive than the failing units, using the

TEC calculations of the Energy Star, which I believe they're looking at adopting, they had a five-year life savings of $3.60 between the two of them. It's a quick check. We can probably find other places where it's not the same. But it just makes me wonder.

There was a comment that 14 percent of the current models in the Energy Star models meet the staff's standards and proposals. And they said monitors would only need to reduce their power 3 to 5 watts. Nobody said anything about what is it going to cost that 3 to 5 watts and exactly what the savings would be in there. There's some general assumptions later, but nothing that tells you how they get from here to there. So I really can't comment on how that was done, don't know anything about it, really.

Some of the vectors they talked about was high-efficiency LEDs to allow the displays to meet the more stringent cost requirements. Didn't really show any cost to volume data to reference in how they validated it. They did look at prices a certain different -- I think LEDs currently on the market. They also mention in their analysis that you could use higher efficiency LEDs and reduce the number of LEDs and that helped -- that cost reduction was -- would help offset the higher cost of the LEDs. There's one problem with that. The number of LEDs is not driven by the cost of the LEDs; it's driven by the capabilities of the optics in the system to evenly distribute the light.

We have looked off previously with really high-efficiency, high-power LEDs, and tried to build displays for notebooks using those, and the problem is the optics. In order for me to get a sufficient path to adequately mix the light so you don't have bright spots and dim spots on the displays, which customers really don't like, I actually have to bounce the light a bunch of more times. And I spend a lot of money on optics paths. And, in notebooks, we absolutely don't have the space. But the assumption that I can reduce the LEDs will not work in all cases, because the minimum number of LEDs is driven by optics and the ability to mix light so you can get an even light distribution across the panel.

Supply/demand, I don't really see factored into it. So part of the reason you see the price delta you do with those more efficient

LEDs is because the lower efficient LEDs are there in volume. If they didn't have those to compete against, those guys would charge a lot more. So there's certainly some market factors that I could see that would oppose the significant shift within the industry over the high efficiency LEDs, besides the fact that I may still need to buy the same number of LEDs, which breaks the cost model, is the fact that, you know, if they don't have sufficient supply in that manufacturer or the existing fabs that built those, then, you know, the whole cost model falls apart again.

And, then, the other one is, I don't know what LEDs they looked at, but they may not meet all of the other design requirements to actually design them into an actual display or panel system. Again, we can't comment on that, but it's -- there are more factors that determine your ability to design an LED into a backlight system than just the efficiency of the LED.

And I said this before, so the high-efficiency LEDs and new technology, new technologies come with a cost premium, over time, they go down, we can't shift a significant portion to the industry to the higher efficiency ones believing that their prices will come down. And when you drive demand for their products, it just doesn't work. They won't cost the same if they have a better performance and there's any kind of higher demand for them.

Automatic brightness control was also one of the things it talked about. We've looked at this over many years over in notebook systems. The first single chip automatic brightness control chip done by a silicon provider was done in collaboration with Dell, and I led the design requirements that went into that part, so I'm a little bit familiar with them.

The cost of the part isn't the cost of what it takes to implement it within a product. First thing is, I need a clear a window in my bezel, or I can't see the light in the room. I need that clear window to be on top of a circuit board where I can put a sensor, or I have to add a circuit board, run cables over the circuit board. So there's, potentially, a lot higher cost, you know. Over time, you can design something to do that. If you have to go retrofit any systems to do this, then that cost is significantly higher than the cost of the LED.

And, then, light pipes, clear plastic windows, you know, changes in toolings to bezels, those things have a lot higher cost that really just wasn't factored into the analysis.

The next one is, we looked at them for years in portable, and we had the hardest time ever getting them into a product because there is no way I can guarantee that a customer is going to save energy. And you can't guarantee that anyone is going to save energy with these.

We've done implementations in mobiles and questioned customers and done customer surveys, and I can tell you that the first time your brightness gets below what the customer likes, he puts the display to maximum and that's where you're stuck for the rest of the product. So under certain use conditions, they will save energy. There's also an equally probable set of use conditions where they will actually increase the energy, because I will be increasing the brightness in a bright room and he might have lived with what he had, but, you know, I'm doing ABS, so I'll bring it up. And if I dim it too much, then, you know, he goes -- customer response is, I'll just go to max brightness and leave it there.

So it's not a bad thing to have. It's probably too costly. And any model, you know, you can't assume that all products are going to actually get energy savings on it, because it's usage model dependent. And then the other one is, the more aggressive you get it, more likely you are to have a customer that takes things in the completely opposite direction.

So we'll take a look -- we used the same limits, we applied it to the Energy Star Qualified Products List, so supposedly, the most efficient products in the market today. This data set was collected like last week, so it's the most recent thing that we can get on ones. But if you look at this, you see that this range of products in -- let me see the models -- in the 17-to-23-inch range has an 8 percent pass/fail -- pass rate of existing Energy Star products. And in -- other sizes are different, have different pass rates. But this one seems to be for -- I don't know the technical or cost reason, but much more aggressively regulated than the other limits. We would certainly like to know what technology gap or, you know, cost problem the industry has in that particular range that makes it warrant such a much more aggressive than the other limit than the other products.

If you take that same database and you break it down by disk space size, and what we did here was a 10-inch -- well, 10.1 and 12.1, that was just those sizes in there, it's not a range of 12-inch products. But for every other one, 17 is everything that was 17, and 17.9 actually went into the 17 bucket, just because we had to bucketize them somewhere so you'd understand what this is.

The curved graph on here, this is the -- the trend line for on-mode power, and then the jagged line is the actual on-mode power for each of these categories. And then, again, we see here situations with 12.1-inch displays, even though they're the lowest on-mode power and lowest energy consumant [sic] of all the displays in the QPL, have a 20 percent pass rate. And then this 17-to-22 range, at 22, we have nothing that passes the requirement. But this range of products have an average pass rates of something under 10 percent of the Energy Star product list, and these supposedly are the best displays.

What's unfortunate in here is that these higher consuming displays that actually have higher energy consumption, all of those pass much, much better. They're a lot more lenient on higher-power displays and more energy-consuming displays, but something about this range is much more deserving of a regulation, I guess. We don't know where it came from, but it's just a discrepancy we're pointing out.

From a technical feasibility standpoint, I looked at some of the studies done about all the features that exist within panels and backlight assemblies and layers and LCD panels, and, yeah, there's a lot of things in there to drive energy reduction, those are things that have been developed over the years to a large extent by industry beating up on panel suppliers and mostly in mobile products, because we -- the panel power on a notebook system is 40 percent of the total energy consumption at idle and it's moving up percentage-wise. As we do a better job of power scaling our system of electronics, the panel power goes up. Because as physics and the capabilities of the panel suppliers, you know, at a certain brightness, it takes a certain amount of energy to make the light, just like it takes it to make a light bulb. We're already in mobile using all LED backlights. Many of the LED backlight systems that are in these panels that are failing, already have LEDs in them.

Another major concern is, since you're so aggressive here and you don't account for some of the factors that actually drive significant energy consumption within a product, color gamut is one of them in particular. And color gamut is, to some -- I guess the other term might be color reproducibility. And there's certain industries where the ability to accurately reproduce color on a panel is very essential. The only way to get there with LCD technology, unless we find a new technology, is more aggressive color filters. And color filters cause you to have less efficiency moving through the panel. Their transmissivity goes down. And those are just physics that we can not a void. And without a proper adder -- there's certain -- the other thing is that there are certainly customers that care, like the movie industry. You know, when they're editing films and doing all their stuff, they kind of want colors on their screen to look like they actually want it to look on the screen at the movies.

So if you don't allow -- this is one of those features that in the more high-performance display kind of thing, and that's where we think it's really essential that we have to be able to do that. Because if you want -- you know, I can make a very low-power display, I'll give you low pixel resolution, really poor color reproducibility, and it's not very bright, and it, you know, it will pass the limit easy, but customers want those features.

There was also a bunch of high-efficiency things described. And I know they're not necessarily used. I'm assuming from what I read that they weren't necessarily used in the predictions in setting limits that the CEC did, but one of these things was Quantum Dots. The cost estimate may not be accurate. I can tell you that display manufacturers have been looking at those capabilities and testing them to put them into panels, and it's never been cost effective. They've never been able to do it at a cost that anybody is willing to pay for. So the technology is interesting, Quantum Dots in particular, I produce color at three primary colors. I can use a lot selects, color filters, and I get better -- good front-of-screen performance about better transmissivity. The problem right now is being able to do it in volume at a cost point that the industry -- that anybody can accept and still sell panels to end users.

So the whole power modeling for resolution differences really wasn't accounted for in there, so I can't talk a whole lot of detail in that.

This is one of the particular studies where they took two panels of different -- of different resolutions from the same manufacturer, supposedly the same technology. If you have significantly different pixel densities, your mother glass may be different, you may be built in a different fab. The two systems nobody accounted for were the power supplies, the exact same power supply -- did you have the same power supply efficiency? Did all the other adders people had in those systems the same? USB ports they had on it? So there was a lot of unaccounted-for variables in there, in the model they used to set, you know, energy use versus pixel density.

And then we get back to the same thing, is, you know, the whole problem with testing a very small number of systems and assuming that all those potential gains can be applied to mass production. Mass production has a problem with having to be able to use multiple suppliers, so you can keep the factory going, and having to do with real-world unit-to-unit variation and, you know, distribution -- energy consumption distribution across, you know, long-term power production.

And that was it. So you didn't have to make me stop this time.

MS. PETERSCHMIDT: Hi. I'm Gabriele Peterschmidt from HP, and I'm doing the concluding slide.

There have been very comprehensive presentations today, so the points that are in these closing statements will be familiar to you.

With what ITI and TechNet knows about customer needs, there are significant concerns with CEC's initial regulatory proposal both from a technical and cost perspective. ITI and TechNet recommend two things to help resolve this. One is that CEC provides the analysis and data CEC used in drafting the computer and displays energy efficiency regulatory requirements. And the second, as has been brought up earlier, is that ITI and TechNet recommends a full-day technical meeting between our industry, CEC staff, and other stakeholders. This meeting should include demos and other means for building agreed fact-based technical foundation for moving forward. We were suggesting late May for this meeting.

ITI and TechNet believes that when there is shared information and common understanding, we can arrive at progressive and meaningful goals. ITI and TechNet will be providing CEC additional recommendations for scope of these regulations, categorization, recommended limits and power-management language.

Thank you.

MR. KUCH: All right. Okay, hi. My name is Chris Kuch, and I'm with Southern California Edison. I'm speaking on behalf of the California Statewide IOU Codes and

Standards Team.

First off, I would like to thank the Energy Commission staff for the opportunity to present today and for working very hard on this very important topic.

Before I hand it off to our technical support team, I just want to make a couple of quick points. First, there is a large range of energy efficiency between monitors and signage displays of similar size and feature sets. And this presents a great opportunity to capture significant savings. And we have conducted testing to show that there are hardware and software solutions to reduce this energy waste and that are also cost effective.

We are generally very supportive of the CEC proposal, although we do see several areas for improvement, which we'll cover in this presentation.

So, next, I would like to introduce our consultants who provided the technical support for this topic. That's Bijit Kundu from Energy Solutions and Clancy with Ecova.

MR. KUNDU: Thanks, Chris.

So, in California, we're seeing the energy use of consumer -- of computer monitors, see it's significant and it's growing in some sectors. Larger, higher resolution monitors are increasing in shipments in the commercial sector. These monitor types are also more energy consumptive than the smaller lower resolution monitors.

Also we see a wide variation in on-mode power consumption among models of the same sizes, resolutions, and feature sets. In some cases, an inefficient model can consume up to five times more energy than a similar-sized efficient model.

So as Chris mentioned before, and I think as CEC staff has mentioned, we see a significant opportunity for a significant cost effective energy savings here.

So the California IOUs believe that the CEC's proposed on-mode levels are reasonable with two adjustments that are noted in this red box here. In the staff report, they were negative signs -- or they were positive signs, and we believe that they should be adjusted to the negative signs. And I think that's what the CEC staff presentation displayed, the appropriate equations with negative signs on the two equations noted here.

So based on the California IOU testing, we think that the case team thinks the adjusted on-mode power -- on-mode proposal is cost effective using widely available off-the-shelf technologies.

There are other aspects of the staff proposal that we'll comment on later on in this presentation, but we just wanted to note that the -- we're generally supportive of the on-mode proposal for computer monitors.

And some of the subsequent slides you'll see are -- will show why we're supportive of these levels.

So this graphic just shows computer monitors of two megapixels or lower that are available today that would meet the CEC proposal. Currently, you can see a wide range of currently available models from all screen size, from 10 inches, at the lowest end, to 32 inches. This actually -- this graph doesn't show, there's some 40-inch models that would meet the CEC proposed levels. And this graph also doesn't show models that just are within a few percentage points of the CEC on-mode proposal. So that's, said in a different way, more models would be able to meet the on-mode proposals by making relatively small modifications to the power consumption.

So not only do we see a wide range of screen sizes, but we're also seeing a wide range of resolutions that are able to meet the CEC on-mode proposal. So, here, you see the blue dots are the two megapixels in lower models that meet today, again, these are models that don't need to make any additional modifications to meet the standards. So you see the blue megapixel models, which we displayed in the previous graph, but you also see the larger resolution models that are able to meet -- again, today's models currently available on the market that can meet the standard.

You can see the wide range of resolutions. You can see two megapixels, 2.3 megapixels, all the way up to 4 and 5K models. The newest highly featured set models are able to meet California's on-mode proposal -- or the CEC's staff report on-mode proposal.

So I think that a previous stakeholder noted that -- I think this chart of available models just notes that this covers a broad range of applications here, not just the standard 2-megapixel models, but also some of the more highly featured models used for professional applications.

So based on testing conducted by the IOUs, the CEC's proposal, the test results from the IOU studies have shown that the CEC's proposal is cost effective. This is just one example of a 22-inch monitor that would not meet the standard and what it would need to do in order to meet the on-mode proposal. You can see the design options listed here on terms of the improvements, and the incremental cost to implement those design options.

It's important to note that the source of this cost data was industry-accepted sources like DisplaySearch, as well as other industry expert input.

And the methodology of this analysis is in the technical report that the California IOUs have submitted to CEC previously.

This is another example, or actually two examples, of a 27-inch representative model that would not otherwise meet the California IOU --

sorry, the CEC staff proposal, and the different approaches it could take -- you take to meet the on-mode levels. So you could see here, in one pathway, you've got a set of design options to increase lamp efficacy, reduce screen default brightness and add dimming capabilities for a $2 to $3 incremental cost. And the second approach here is -- lists out for $5 to increase the lamp efficacy even more and just reduce screen brightness.

And, again, you know for all of these examples, there were other multiple pathways. And I think the point here is that, you know, there's not just one way to meet the standard and there's not -- you know, you don't need Quantum Dots or you don't need OLEDs to meet the proposed levels. These are off-the-shelf technologies.

When we talk about kind of the cost to consumers, this slide shows an exhibit, or two examples, of two monitors we -- similar feature sets, similar size. This is a 22 -- these are 22-inch monitors. So you can see here the retail price is listed out for a model that would meet the proposal versus one that would not meet the proposal. The one that would meet the proposal is actually cheaper than the one that actually that would not meet the proposal, by $10. And then we've calculated the lifetime cost here of the two models and, of course, the one that would meet proposal, that's cheaper -- or less expensive, I should say -- and that is, not surprisingly, less expensive when you calculate the lifetime cost. And the lifetime cost just calculates what the energy consumption would be over the lifetime of the product and the cost to the consumer for that.

This is an example of two, 27-inch monitors that would meet the -- or one that would meet the on-mode proposal and one that would not meet. In this case, the one that would meet is more expensive by a few dollars, but then when you calculate the lifetime costs here, you can see that the overall lifetime costs of the model that would meet the proposal is less expensive than the lifetime cost of the one that would not meet the proposal over the lifetime of the product.

Shifting gears a little bit, just talking about the test procedure, I think the California IOU team supports the Energy's -- reference to the Energy Star test procedure Version 6 with two exceptions. I think, one, we would want the testing to be conducted as shipped for in the default -- factory default settings rather than calibrated to 200 candelas per meter squared. And I think that's -- you know, I think we see that when the settings that are shipped in factory default, or most often this -- the settings that are in actual use. And so to better reflect actual energy usage, we would recommend the default settings to be -- and the testing to be conducted in the default settings.

And then if testing is conducted at default, we would want some requirement, the IOU team would want some requirement, that the luminesce in the default should be within a certain percentage or 65 percent of the luminesce in the brightness setting just to ensure acceptable -- an acceptable picture out of the box. We saw this with TVs, and I believe it's a requirement for TVs as well.

So I won't get into any of these bullets right now for time's sake. As noted previously, the IOUs are looking into several other items of the CEC staff report and we'll be providing more detailed information in our written comments.

The items that we're looking into are listed here, revisiting the standby and off-mode requirements.

What we've seen is that a vast majority of the models available on the market today can meet the sleep and off mode -- and when I say "vast majority," I think all about less than two percent on the market, a handful of models that have a standby of greater than 1 watt.

So we're looking into -- or we're looking into an analysis to revisit the standby and off-mode levels. And I think one of the previous stakeholders kind of noted the disjointed quality -- you know, qualifications or on-mode levels. I think we'd like to investigate a continuous line approach similar to what Energy Star is proposing in Version 7. Not a similar line, but a similar approach of a continuous line instead of the screen size bins.

I think we're also -- the case team is also looking into flattening out the on-mode curve at larger screen sizes, reexamining the reducing the resolution adder for larger resolutions, including power management requirements. And, finally, I think it was noted previously, consideration of an adder for enhanced performance displays and the added features and functionalities of those products.

So switching gears a little bit and talking about signage displays, I'll try to run through this in the interest of time. You know, we see energy use of signage displays growing. The shipments are increasing about 10 percent every year in California of -- for signage displays. Signage displays are typically brighter and larger than TVs and, therefore, more energy consumptive. In fact, the unregulated sizes of signage displays, that is greater than 1,400 square inches, they comprise a third of all total shipments of signage displays. So there's a huge opportunity here. And unlike TVs, which are typically -- I believe the CEC staff mentioned this, unlike TVs which are typically on just five hours a day, some signage displays are on three to four times greater than the five hours.

This plot just kind of visually shows you the difference in just the on-mode power, difference between signage displays and TVs here.

The TVs are the orange dots, and the signage displays are the blue dots. So you can see, in some cases, signage displays can draw almost four times more power than a TV of the similar size in on mode. And when you calculate the daily duty cycle, with the duty cycles being three to four times greater, now you're talking about a 12X difference, 12 to 16X difference, in overall energy consumption.

So because of these reasons, we -- we support CEC in clarifying the applicability of the current standards to signage displays, and we support consideration of a more stringent on-mode level across all screen sizes up to 1,400 square inches and beyond within the scope of this particular rulemaking.

IOU testing results indicate more stringent on-mode levels are cost effective and technically feasible, and we'll be -- the IOU team will be submitting comments, more detailed comments, with the cost effective analysis to the CEC in written comments.

And one other note is that we do think, based on the testing that we've done, that on-mode equation should account for both luminesce and screen area, which I believe Energy Star Version 7 is also considering for their signage display update.

So here's just a summary of the key points from the presentation today. CEC's on-mode proposal with the noted adjustments that we called out is technically feasible and cost effective across all screen sizes and resolutions. CEC should consider lowering standby and off-mode levels, and testing should be conducted in default settings for computer monitors. For signage displays, we think CEC can set more stringent on-mode levels, and that on mode -- and more stringent levels are cost effective and technically feasible. And signage displays larger than 1,400 square inches account for a third of the market and should, therefore, be included in this rulemaking.

Thank you for this the opportunity for talking today.

***MR. SINGH: Thank you, Bijit.

With that, we'll take the questions from the -- do you have blue cards, Ken? Any? Okay.

If any of you have any comments, you know, you can come to the podium and make the comments.

Okay. If not, you want to check the comments on the computer again.

MR. RIDER: Let's see here.

Yeah, if you have an interest in commenting and you're on the phone, just ask that you raise your hand and we will unmute you, or write something and chat, too, and I'll meet you if you say something to me.

Okay. I'm going to go ahead and unmute folks that are just calling in without WebEx access. And your lines are unmuted if you're just a call-in user. If you'd like to make a comment, this is your opportunity.

(No audible response.)

MR. RIDER: Okay. Don't hear any. So, I guess, just to wrap up the workshop then, you know, this is -- we had a great meeting. This is exactly what these workshops are designed to do and why we don't just do rulemakings directly, because it's so critical to have industry feedback. It's really important to have a standard to talk about to do that. This draft standard is that standard. And I think we had really fruitful conversation, it sounds like.

And we certainly will be in continued conversations about where the next draft might go.

And thank you all for taking the time to travel out here, spend a pretty good part of a day in this room together working out potential standards for computers and displays.

MR. SINGH: I just want to mention one more thing, that the comment period is till one month --

MR. RIDER: May 15th?

MR. SINGH: Yeah, May 15th. So, you know, we are looking forward to receiving your comments on May 15th or before that.

MR. RIDER: Yeah. And just to be clear, too, I mean, if you have any questions or clarifying needs on the staff report or things that we said today or whatever, Harinder and my contact and our presentations, those will be on the web. If they're not -- I think they already are on the web. And just feel free to call us or send us an e-mail and don't wait until public comment to get that resolved.

Thanks.

Sure, go ahead, Shahid.

MR. SHEIKH: Shahid from Intel.

Regarding the submission by May 15th, one of the request that industry had was to get some more data available, you know, not just the final numbers but data behind the numbers. Would CEC be open to sharing that and making it available so that we can have a meaningful response?

MR. RIDER: Well, what I think what we need to do is figure out the disconnect here. Because we put out a staff report we felt was supported with data. You guys -- and I'm not -- you know, let's figure out what the disconnect is, and then we'll do our best to close that. I think talking with you and maybe take this offline, we'll talk about the best way to get that. And, certainly, we'll try to make sure you have everything you need to make substantive comments before the end of May, before the comments are due. But how that's done, let's work -- let's talk and --

MR. SHEIKH: Yeah. I think the staff report summarizes some of your conclusions, but there may be data behind the scenes that we just don't have, that we're not privy to. That's what we're --

MR. RIDER: Yeah, and I think there's some very specific areas that you're more interested than others. Let's talk, figure out what those are --

MR. SHEIKH: Okay.

MR. RIDER: -- and we'll see what we can do.

MR. SHEIKH: All right. Thank you.

MR. SINGH: Okay. Thank you everybody for joining it, and this concludes our presentations and the workshop.
Thank you.

(Whereupon, the workshop concluded at 4:24 p.m.)

REPORTER'S CERTIFICATE

I do hereby certify that the testimony in the foregoing hearing was taken at the time and place therein stated; that the testimony of said witnesses were reported by me, a certified electronic court reporter and a disinterested person, and was under my supervision thereafter transcribed into typewriting.

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