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BEFORE THE

CALIFORNIA ENERGY COMMISSION

In the matter of,) Docket No. 17-BSTD-01

2019 Building Energy Efficiency Standards PreRulemaking

STAFF WORKSHOP ON

NONRESIDENTIAL HEATING, VENTILATION AND AIR CONDITIONING

(HVAC) MEASURES FOR THE 2019 STANDARDS

CALIFORNIA ENERGY COMMISSION

FIRST FLOOR, IMBRECHT HEARING ROOM

1516 NINTH STREET

SACRAMENTO, CALIFORNIA

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Reported By:
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INDEX

P R O C E E D I N G S

JUNE 20, 2017 9:39 A.M.

MR. ALATORRE: (Presentation in progress) -- from 14 up to 16.1 gallons per minute per horsepower for propeller or actually closed circuit quintars.

On the VRF side here the increases in part load efficiency.

And lastly, there was a change in the footnote from NAECA to the U.S. Department of Energy Federal Regulations.

This proposal, we do this every cycle, update the efficiencies to reflect what was done in 90.1. And at this point I'm ready to take any questions. What I included here is a docket number. If you wanted to submit questions or comments, you can do it to this docket number and e-mail to our dockets unit.

So, I am ready for questions if there's any online or any in the room.

MR. PAYAM BOZORGCHAMI: There are none. One person's asking about the links. Is there the other page of links that you can show him?

MR. ALATORRE: This is the only page I have links on.

MR. PAYAM BOZORGCHAMI: So, this is Payam, again. On the presentation I did our links. So, you can go to go look at the case reports (inaudible) -- and also, if there's other comments you can submit them to us.

MR. ALATORRE: Okay, with nothing further I'll go right into the next topic, which is cooling tower efficiency. So, again, I'd like to acknowledge the California Statewide Codes and Standards team, and the case authors Stefan Gracik, Matthew Dehghani and Anna Brannon, all from Integral.

A little background on cooling towers, they were first introduced under the 2001 California Building Energy Efficiency Standards. At that time the efficiency requirement for propeller or axial fan cooling towers was 38.2 gallons per minute per horsepower. At that time, 5 percent of the cooling towers that were available could not meet that. This was in response to a 90.1 requirement.

Some more background, after 2001 there was an attempt to increase the efficiency in the 2013 rulemaking, and they were pretty aggressive. They went from 38.2, they wanted to recommend 100 gallons per minute per horsepower. And they showed in the case report that it was cost effective.

However, during the stakeholder meetings and rulemaking there was industry reaction. At that time nearly 90 percent of the cooling towers that were available could not meet the 100 gallons per minute per horsepower requirement. And there was fear from the industry that it would push designers to spec air cooled chiller plants.

So, instead of getting to 100, they got only 42.1, which was a 10 percent increase. 90.1 at the time upgraded their cooling tower efficiency by 5 percent. The reason there was a different is that unlike 90.1, California Energy Standards has a limit on air cooled chilling plants at 300 tons. So, if you exceed that capacity, you must install a water cooled system. So, that gave the allowance of the extra 5 percent increase in cooling tower efficiency.

So, for this code change, the CASE Team's recommending another increase in cooling tower efficiency up to 80 gallons per minute per horsepower. They want this to be a prescriptive measure and it would be applicable to all new construction and replacements. With an exception for building-mounted replacements that would be either on the roof or in the building. And it's also for systems 900 gallons per minute and larger.

So, as I mentioned previous attempts to increase the efficiency resulted in concerns that they'd be pushing designers to spec air cooled plants. But again, we have a cap at 300 tons, so that fear shouldn't happen. Also, in previous stakeholder meetings and this rulemaking cycle there was some concern about product availability, structural design to accommodate the added weight and available roof space. And all of those were addressed in the CASE report.

The CASE Team did a survey of available products and it turns out that 45 percent of the available products can meet this efficiency.

Also, they did an interview with a structural design firm and they found that, on average, 80 percent and beyond, meaning per horsepower tower, when you compare the weight to a 42.1 gallons per minute per horsepower tower, the weight increases from 30 to 40 percent. According to the structural design firm, that would not increase the structural design in any significant way. However, if it was double the weight, then it would be on the order of $2,000 for the increased cost of additional steel.

As far as the concern for roof space, the CASE Team noted that this is a prescriptive requirement that makes it available for tradeoffs. Also, it doesn't necessarily have to increase the footprint of the cooling tower. It could be a taller cooling tower. And not all towers are required to be roof mounted. You know, some are mounted on the ground for, you know, a university or something on that order.

And also, if there's exceptions to this requirement if the -- on alterations, if the existing cooling tower is building mounted. So, they try to address all the concerns that were brought up during the stakeholder meetings.

In their energy analysis, they chose two prototype buildings, one office and one school with these features. And the first year impact for the large office, there was an electricity savings high of .12 kilowatt hours per year, per square foot, and a demand reduction high of 5.7 kilowatt hours -- or kilowatts, I'm sorry, and a TDV savings high of 4.53 TDV.

For the large school it had a little bit less of an impact but, however, there was savings across all climate zones.

The energy cost savings is outlined here and this is all per square foot, I'd like to remind everyone. Here's the result for the large school. As far as incremental cost, they surveyed three major manufacturers and they tailored the incremental cost based on the design flow for each prototype in every climate zone, given that they load would change. And they calculated a percent increase in cost compared to a baseline of 42.1 gallons per horsepower tower.

And so, that's where we get the average actual efficiency. It would be the average of the three available cooling towers in the capacity that would meet the minimum 80 gallon per minute per horsepower and can satisfy the flow rate.

So, using the cost savings in incremental costs, we got benefit cost ratios showing that this measure was cost effective in all climate zones except 1 and 16, for the large office. And that similar trend for the large school, it was cost effective in all but 1 and 16.

So, for the proposed code language they recommend amending Section 140.4(h)(6) to say "Cooling tower efficiency, New or replacement open-circuit cooling towers serving condenser water loops which total 900 gpm or greater, shall have a rated efficiency of no less than 90 gpm/hp when rated in accordance to the test procedures and rating conditions as listed in Table 110.2-G."

Again, adding the exception for replacement of existing towers that are inside or on the roof of the existing building.

Or, if you're in Climate Zone 1 and 16, since it proved not to be cost effective in those climate zones.

So, at this time I'm ready to answer questions either in the room or online.

MR. WICHERT: So Mark, I'll go ahead and there's a question about the cooling tower requirement staying at 42.1 gpm per horsepower. Is that the --

MR. ALATORRE: I think the referencing was the mandatory minimum requirement and what we're proposing is a prescriptive increase.

MR. WICHERT: So, it says, "Is the building mounted cooling tower requirement staying at 42.1 gpm/hp?"

MR. ALATORRE: Yes. On replacement systems, yes.

UNIDENTIFIED PUBLIC SPEAKER: I'm sorry, I didn't get that. So, replacement systems will stay at 42.1 --

MR. ALATORRE: Replacement systems that are building mounted. So, if you're replacing an existing tower that's on the roof or inside the building, the minimum would stay at 42.1.

We're good? All right. This next topic is Waterside Economizer. Acknowledging, again, the Statewide Codes and Standards Team, and Stefan Gracik from Integral.

Some background on water economizing, it's the method of using a chilled water plant's cooling towers to directly provide cooling for the chilled water plant, bypassing or working in series with the chiller. So, here's a schematic of the key components.

Non-integrated water economizing is what would be called bypassing the chiller and it is used when the outdoor wet-bulb temperatures are sufficiently low, the cooling towers are able to provide water at the design supply temperature and able to turn off the chiller.

An integrated water economizer has the same benefits as a non-integrated, with the added benefit of working in series with the chiller and able to pre-cool the chilled water coming into the chiller.

So, both integrated and non-integrated economizers are comprised of the same components, cooling tower, heat exchange, pumps, sensors, and controls. The systems, however, are rated by their approach. And the approach is defined at what wet-bulb temperatures can be required, or what level temperatures can be reached depending on ambient. So, typically, a cooling tower can reach 5 degrees according to what's the ambient wet-bulb. And the heat exchanger can -- a heat exchanger, a typical approach is 4 degrees.

So, for example at 45 degrees wet-bulb, a 9 degree approach on a system would supply 54 degree water.

Lowering the approach will increase the amount of hours that you can water economize and, yet, still get the desired water temperature. So, instead of 45 degrees, if we increased that minimum to 49, if we lower the approach from 9 degrees to 5 you can still cool the water down to 54.

And in doing so, looking at Sacramento, the amount of hours that you can -- at 49 degrees or lower, you can get pretty close to the same amount of hours that you would be using an airside economizer.

So, the proposed code change is to expand the current water economizer requirements in 140.4(e). By doing a more stringent system approach that would be increasing the minimum from 45 degree wet-bulb to 49.

And align with ASHRAE 90.1 for requiring specifically an integrated water economizer, adding requirements for a max pressure drop for the heat exchange, to accommodate the pressure drop by the heat exchanger. And also, to require water economizing on passive or hydronic systems, which previously has not required water economizing.

So, in the energy analysis they chose an office building, 500,000 square feet, 13 stories. In the base case, the base case incorporated non-integrated economizer, with a 9 degree approach and a cooling tower efficiency of 42.1 gallons per horsepower.

The proposed design had a fully integrated water economizer to take advantage of the pre-cooling, with a more stringent 5 degree approach. And they chose the 80 degree gallon per minute horsepower tower, as recommended in the previous proposal.

So, here's the first year energy impacts and on the far right column is the 15-year electricity cost. This is only in electric savings, electricity savings measure since it's all about cooling. And we had -- that resulted in a high of TDV, in Climate Zone 5, 11.99. A low TDV of 2.69, in Climate Zone 11.

So, lifecycle costs. Costs, as we mentioned before there are integrated versus non-integrated. They're comprised of the same components. It's all about where you're mounting the heat exchanger. The difference in an integrated economizer would be an added sensor. But the controls will be the same, the control costs. The algorithms would be different, but the programming costs would be the same.

But there is a cost in the lower approach cooling tower and the lower approach heat exchanger. So, that is what was incorporated into the incremental costs.

So, the assumption is 75 percent cost increase for the cooling tower and, let's see, the base cost for the heat exchanger is sourced from a contractor quote for a 2 degree approach tower.

So, using this incremental cost in energy savings we got a cost benefit ratio showing cost effectiveness in all climate zones, resulting in a statewide energy savings impact of .25 gigawatt hours.

MR. GRACIK: Hey Mark? Mark, this is Stefan, the case author. I just want to make a comment. I think the cooling tower increase was not 75 percent. I believe it was closer to 20 or 25. I think the heat exchanger was the one that was 75.

MR. ALATORRE: Oh, the heat exchanger was 75, okay.

MR. GRACIK: Yeah.

MR. ALATORRE: This measure also had water impact. So, because we're using more cooling water economizing hours that's less evaporation, so there's a net savings in gallons per year. And so, we have a 3.24 gallons per year per square foot impact.

And also, there's an increase in steel for the heat exchanger.

So, for the proposed code change this is the higher approach -- oh, that's the lower approach, the 5 degree approach change. It would increase from 45 to 49 degrees wet-bulb.

And then an added section here that would require that each central chilled water system that has a designed total mechanical cooling capacity over that listed in Table 140.4-D, which is a new table, shall include a waterside economizer capable of providing 100 percent of the expected system cooling load as calculated in accordance with the method approved by the Energy Commission, at the outside air temperatures of 54 and 49.

And so here we have a table showing the minimum capacities based on the cooling system type.

Also, the max pressure drop requirements for the heat exchanger, to come into heat exchanger we have it to be no less than 15 feet of water. And then there is an added heat rejection energy impact. This would be to have no added heat rejected energy in use when the water economizer is not in operation. And also, or, air cooled chillers with the water economizer heat rejection coil in series, with the refrigerant condensing coils meet the Efficiency Table 110.2(d), which is the air cooled chiller efficiency table.

And then the last requirement is for the economizer system to be fully integrated.

Okay, with that I can take questions.

MR. WICHERT: Nothing online. Oh, actually, we do have an online question. Frank, I unmuted you. Go ahead and state your name and association.

MR. MARSTON: Thank you. This is Frank Marston with Baltimore Aircoil Company. I couldn't unmute myself for the original one with the cooling towers, but I think the industry still has some concerns with the increase to 80 gpm per horsepower, but we'll send you in our further comments.

But specifically to this economizer issue, you ran your study with 42.1 and the current requirements for temperature, and then looked at the case with 80 gpm per horsepower and new temperature requirements. Did you run that with the same gpm per horsepower so that you could compare the impacts of just increasing the efficiency of the power versus making the duties more stringent?

MR. GRACIK: Hi Frank, this is Stefan. I'm the case author. Right, so we did, we ran the baseline proposed with the separate cooling tower efficiencies based on the other cooling tower code change proposal. We had received some comments on that discrepancy and we are working on updating the analysis so that both cases are run with the same cooling tower efficiency.

We were carrying a cost increase for the cooling tower to be for a higher existing cooling tower in the proposed case. But I guess to make the comparison more apples to apples we should rerun it with the same cooling tower efficiency in each case. So, the final CASE report will have that updated analysis.

MR. MARSTON: Yeah, we'd be very interested to see that. You know, because you probably well know, that as you get closer and close this approach here weight, cost and everything goes up significantly for a cooling tower, as well as plate frame heat exchanger.

And then to throw on the requirement to be 80 gpm per horsepower, you know, your cost is going to be significant, as well as the available models that can be used. So, we would appreciate that, thank you.

MR. WICHERT: We have another comment online. Jeff, I'm going to unmute you, now. Please state your name and association?

JEFF: Hi, I'm Jeff Stein Taylor Engineering (inaudible). Mark, I have been paying attention, so this might be a dumb question, but it sounded like water economizers are required for all plants over a certain size? Is that right, even if the plant shares loads with airside economizers?

MR. ALATORRE: Yes, but there was a capacity table that was proposed. I can bring it back up on the

-- so, it would be according to this table.

JEFF: What's the plan? Is serving air handlers that have airside economizers -- you wouldn't have any savings from the water economizer?

MR. GRACIK: Can we look back at the previous slide? I may need to reexamine how we wrote the code language. The intention of the code is that a system with an airside -- oh, sorry. Sorry, the code language is specified calculating your -- so, there's the capacities that require -- sorry, the capacities that determine when a waterside economizer is required for the chilled water plants, the capacities are calculated by first subtracting out the capacity of air economizers from the total chilled water cooling capacity.

So, if the full building is cooled with airside economizer, or if the full building is capable of airside economizer then the effective capacity will be zero and a waterside economizer would not be required for that.

JEFF: So, if you go to the table on the next slide it does --

MR. ALATORRE: So, if you look at the heading there, total building chilled water system capacity minus the capacity of cooling units with air economizers.

JEFF: Okay. And isn't it already captured on the previous slide where it says if you -- you have to have an air or water economizer? This is basically capturing like small coils that are below the 54,000 or whatever. But if you have enough, then you'd have to have a water economizer. Is that kind of where this is going?

MR. GRACIK: Yeah, that's the intention is to capture chilled water plants.

JEFF: Okay.

MR. GRACIK: I might add that a common building type that uses the small fan coil units is like the hotel or high rise residential. And those types of buildings are exempted from economizer requirements. So, those buildings would not be covered under this code change proposal.

MR. WICHERT: We have another question online. I'm going to go to Skip. All right, Skip, I just unmuted you. You'll have to restart. State your name and association, please. Thank you.

MR. BURNS: Skip Burns with Diken Applied (inaudible) Applied. Water cooled unitary equipment also use water economizers and will need to be -- these studies are not really applicable to that type of equipment. I mean, they don't use plate frame heat exchangers. They just use, usually, fin tube water (inaudible) coils in series with the evaporator coil. I think these systems are going to run into some compliance issues trying to reach this level. And on replacement equipment you would have some real difficulties.

MR. ALATORRE: Thank you, Skip. Could I encourage you to submit a letter to the docket, outlining what these issues would be?

MR. BURNS: Okay.

MR. ALATORRE: And then, we could accommodate, if need be.

MR. GRACIK: Skip, this is Stefan. I just want to respond and say I've heard your comments before. And we are still trying to -- I mean, the system type is seen as rare in California, and we're still trying to understand how we can incorporate it into our analysis, which is mostly focused on waterside economizers with BAV systems. So, I encourage you to maybe reach out again to me, and we can continue the conversation. And also, please submit public comments to the CEC.

MR. BURNS: Okay.

MR. WICHERT: And that should do it for online comments.

MR. ALATORRE: Okay.

MR. PAYAM BOZORGCHAMI: If there's no more comments on this one, let's take a five-minute break. I want to get some water. It looks like we're a little bit ahead of schedule. For some reason we caught up. So, we may do Fan System Power before lunch. And maybe even Exhaust Air Recovery.

MR. ALATORRE: Yeah, if we continue to get no comments then, yeah.

MR. PAYAM BOZORGCHAMI: Thank you.

(Off the record at 10:08 a.m.)

(On the record at 10:20 a.m.)

MR. ALATORRE: We're good, RJ.

MR. WICHERT: We're going to go ahead and get started. We have another question for the previous presentation. Ben, if you're ready I'm going to unmute you, now. Go ahead and state your name and association.

MR. DOLDICH: Yeah, Ben Doldich with Liebert Vetiv. I've really got two. There are some newer designs for data center applications that utilize refrigerant economizers, ala turn the compressors off and just circulate refrigerant. How are those considered under the guidelines of water economizers? And then, should the language be changed to more broadly accept all fluids?

MR. GRACIK: This is Stefan, the CASE Report author. And I believe data centers are covered under a separate section of Title 26, so our measure would have no effect on data centers.

MR. DOLDICH: Okay. And then, can I ask a second, just related to the newer ASHRAE Standard 90.4 for data centers, what implications, if any, of what's being discussed today has considered that standard?

MR. ALATORRE: So, we have not considered any proposals or any other requirement that's within 90.4. This is only 90.1 measures that we're considering.

MR. DOLDICH: And then, what is the process for California to consider 90.4?

MR. ALATORRE: Well, technically, we're not required to consider 90.4 since it's not a National Model Code. We're required to consider 90.1, since it is.

But like any other proposal, anybody can submit a proposal following the CASE Report template, if you had a measure. At this point it's a little late in the process to get a full measure vetted and proposed for 2019.

MR. DOLDICH: Okay, thank you.

MR. ALATORRE: We're good, now?

MR. WICHERT: Okay.

MR. ALATORRE: So, we're moving on to Economizer

Fault Detection and Diagnostics for Built-Up Air Handlers.

I'd like to acknowledge the CASE authors for this measure, Farhad, Catherine, and Hillary, from TRC and Integral.

And a little measure background, fault detection and diagnostics, or FDD, it's been a mandatory requirement since the 2013 Energy Efficiency Standards Update. It's applicable to systems over 4 and half tons that incorporate in their economizer. But it's limited to packaged systems.

And under the 2013 requirements there was language that required the manufacturer of the FDD device to certify to the Energy Commission that it met the requirements. At that time, once after adoption we were getting questions from manufacturers as to what test method they had to certify to, since there was nothing at that time, you know, setting kind of a bottom bar.

So, the Energy Commission worked with industry to come up with a document that wasn't a requirement. However, it gave guidance to manufacturers on testing and certifying to the Commission, which all of the FDD manufacturers followed.

Under the 2013 standards, the faults that needed to be detected were air temperature sensor failure faults, the economizer not economizing when it should -- economizing when it should not, damper not modulating and excess outdoor air.

And also, the FDD system needed to provide the HVAC system status. And those included free cooling, economizer enabled, compressor enabled, heating enabled if it had heating, and also mixed air low limit cycle was active.

Under the 2016 update, the guidance document that staff developed with industry, it got incorporated into the reference appendices and became a mandatory test method for a system certified to the Energy Commission.

And the previous listing was grandfathered into the new certification listing and granted that they all had submitted under that test method.

Under the 2016 standards there were no other proposed changes to the fault detection capabilities. No changes to the systems that it was applicable to or anything else.

But this proposed change is going to expand the requirement to built-up air handlers, not just packaged rooftop systems. And it’s still triggering 4 and a half tons or larger, but it’s moving away from these stand-alone FDD devices to DEC-controlled systems for the larger HVAC systems.

So again, under current regulations the FDDs had to be certified to the Energy Commission. And if we go forward with this recommendation it would expand. And, you know, we looked at requiring DDC-based systems to also be certified to the Energy Commission. However, there were some problems with that given the different people that could be involved in stalling these systems. It could be the mechanical designer, controls contractor, third-party FDD vendor, or DDC manufacturer, all who could have responsibility over the sequence of operation.

So, I got a little ahead of myself. So, yeah, each one of these could have responsibility over inputting the sequence of operation. And also, sequence of operations are optimized per building, so certified pre-configured modules was problematic given that they would be changed once they got installed. So, there was little sense in requiring them to certify if that's not what was going to be installed, or that's not how the building would have been operated.

So, we're trying to avoid adding inflexibility in the way these systems are operating.

However, instead of requiring certification, the

CASE Team's proposing an acceptance test, an amendment to an existing acceptance test that would require a more rigorous test to ensure proper system setup. And that, we feel, would ensure that the system was operating according to the intent of 120.2 and the FDD fault requirements.

So, the proposed code change, again, is not to require certification on DDC, but require the acceptance test to be a little more stringent.

So, the acceptance test that they identified is found in the nonresidential appendices, Section 7.5.12, and the associated form is the NRCA-MHC-13.

So, this form, currently, it includes functional testing on heating and cooling coil valves and zone terminal units. The Case Team's recommending that we split this form into two, an A and B. The A will contain the new acceptance test and the B will remain what it is, currently.

So, the changes that they're recommending to the acceptance test, it would require inspecting of the sensor accuracy, giving direction to override any alarm delays. So, some FDD systems wait for a specific fault to reoccur several times, and it may be over a long period of time before it actually reports the fault to ensure that it's not an anomaly. So, there needs to be some direction given to override that delay.

To disconnect local temperatures and not global sensors. Global sensors can give a false fault detection. And also, direction on which actuators to -- or, how to test the actuators versus actually unplugging them. You can actually harm or actually kill an actuator if you disconnect it wrongly or reconnect with their power going to it, you can burn it up. So, they give some more direction on that.

As far as energy analysis, they chose a prototype building, a large office, 13 stories with a central plant. And they modeled the five faults that are required under 120.2.

They assumed an FDD benefit by making these assumptions. The air temperature sensor malfunctioned. They felt over 15 years it occurred 20 percent of the time. And if there was an installed FDD that fault would be caught 75 percent of the time. If they didn't have an FDD, only 25 percent of the time would a maintenance person or building operator find that temperature sensor failure.

They claim that these assumptions are conservative. They think an FDD would have a better capture rate and they don't think the building maintenance person would necessarily find the sensor failure on that high of a rate. But on the conservative side they chose 75 percent and 25 percent.

And then, on the far right column they showed how they came up with the FDD benefit. So, for each of the five they calculated this benefit and they applied these savings to the simulation run.

So again, they applied it to the expected energy impact of the simulated faults and the benefits were some to yield in energy and cost effectiveness result.

So, for the first year impact it had a high of .05 kilowatt hours per year, and demand reduction expected to be between .068 and .02 watts per square foot. This is the 15-year cost savings.

Now, for determining incremental costs, they interviewed three mechanical designers and came up with $2,604 for the contractor to implement a return air temperature sensor and FDD sequence of operation, as well as a mixed air temperature. Is that what that means, a mixed air temperature sensor?

And these costs are per air handler. So, in the prototype there were 13 stories, 13 air handlers, a total cost of $35,804.

Compare that to the energy savings and came up with a cost benefit ratio showing cost effectiveness in all climate zones.

For the proposed code language -- yeah, I didn’t actually incorporate that one into the slide show but -- here we go. They’re proposing to make amendments to Table 100-A. This would include computer room fault detection requirements and then amending the actual FDD language in 120.2 to say “All newly installed air handlers with a mechanical cooling capacity greater than 54,000 or the 4 and a half tons.”

So, this, eliminating the “air-cooled package language”, so this would make it applicable to all system.

They had some other recommended changes. Instead of saying “compressor enabled”, say “mechanical cooling enabled.”

They also recommend making these amendments to the rest of the 120.2(i). The unit controller shall allow manual initiation of each operating mode so that the operation of cooling systems, economizers and heating systems can be independently tested and verified.

And then had the exception that the algorithms based in DDC systems are not required to be certified to the Commission.

Additionally, they wanted to make changes in JA 6.3. This is where they had the test requirement for the stand-alone FDD, or the FDD devices rather than DDC based. Similar to what's in 120.2(i).

And further down, here's the recommended changes to the acceptance test. So, first, verify the installed sensor accuracy. In the functional test you would bypass the alarms and then you would initiate the different alarms to create faults. And these faults that are being initiated are in accordance with what's required in 120.2(i).

So with that, I am available to answer questions on this topic.

MR. PAYAM BOZORGCHAMI: This is Payam. The presentations that you will see today will be posted on our website tomorrow. And please submit your comments by June 7th -- July 7th, excuse me.

MR. ALATORRE: No? Okay.

MR. WICHERT: Mark, we actually do have one question that just came in.

MR. ALATORRE: Okay.

MR. WICHERT: Alex, I'm going to go ahead and unmute you. Go ahead and state your name and association.

MR. CARILLO: Hi, my name's Alex Carrillo. I'm with the Pelican Wireless Systems. I have a question on the fault detections and that is how are those faults to be delivered? Is this something with the packaging and/or is there a fault to be delivered with some method that has to notify somebody somehow?

MR. ALATORRE: That's a good question. Let me bring up the existing language in 120.2(i). It gives direction. If you look at number 6, on how faults are to be reported, so currently faults are required to be reported to either an energy management control system or enunciated locally at zone thermostats.

Or, for the fault management application that automatically provides notification to the HVAC service provider. So, any one of those three ways.

MR. CARRILLO: All right, thank you.

MR. ALATORRE: Sure.

MR. WICHERT: I think that's all the online questions.

MR. ALATORRE: Okay. I am. Do I just keep going? All right.

Okay, the next topic is Fan Power. I'd like to acknowledge Ken, from Integral Group.

And I'll do a background on fan systems. System fan power, it's affected by basically anything that's in the duct system. You know, everything that adds static pressure to the fan.

Fans consume -- the fan motors consume watts --

let’s see, let me start over.

So, watts consumed by the fan motor versus the amount of air moved by the fan, and that’s how we come up with the fan efficiency, basically.

The less power needed or the less watts or horsepower to move the same amount of air results in a more efficient fan.

Static pressure is what makes the fan work harder and consuming more power. And there, again, anything that’s inside the duct system would add static pressure. It would be the cooling/heating coils, filters, and the ductwork, itself.

Currently, fans are regulated under 140.4(c). They were first introduced in the standards in 1992. The efficiency metric is watts per CFM. And currently, there’s no limit to the added static pressure due to filters.

Since its introduction in 1992, DOE has updated their fan motor efficiency several times. However, Part 6 of the Energy Standards has not updated its fan power allowances.

Under the 2013 update to Part 6 there was a change in the reference software. The simulation engine went from DOE-2 to EnergyPlus, and in that change came a shift in fan power. Before under the DOE-2, the

140.4(c) was implemented, and with the change to EnergyPlus the standard design under the performance software actually shifted and required a more stringent fan requirement.

So, the standard design under EnergyPlus actually resulted in a more stringent requirement than what's prescriptively required.

And right here, at the bottom table, you can see the results of that. The allowed total static under the prescriptive approach allows constant volume total static of 3 inches, 3.96 inches, and variable volume 6.18.

However, in the standard design under the ACM, those numbers are significantly lower.

So, under this code change proposal the CASE Team's recommending that we adopt ASHRAE's calculation method for allowed fan power, as well as fix the discrepancy that's currently in the software.

So, that would result in being more stringent than 90.1. If you look at the table below you'll see what 90.1 allows for total static for constant volume versus variable air volume.

We have been requiring something more stringent than that for any building complying under the performance approach since 2013. So, this would be more of a formality to get that discrepancy fixed.

I'd like to point out that the CASE Team did a survey on packaged air-handling units. And they noted that basically any unit under 5 tons are not affected by this proposed code change, since the fan motor nameplate is under 5 horsepower.

And for packaged units that are larger than that, it's a limited number of cases where the packaged unit would not comply. And that would be if they had a low air flow to a high static ratio.

So, what's currently required by ASHRAE is for there to be, for all supply, return fans and exhaust fans at the system level, the AV boxes and zonal exhaust that are greater than 5 horsepower, they need to comply with the maximum fan power.

And there's adjustment factors for filtration and energy-recovery devices, which I'll show in the table under the proposed code language.

For the energy analysis, they chose two prototypes, the large office and medium retail. Again, a bit different under this energy analysis is that the standard design is actually what we're trying to formally make the prescriptive requirement.

So, the proposed design model, what's in the prescriptive requirements under 140.4, that would be for a AV system to have a max watts per CFM of 1.25 and a total static maximum of 6.231.

What that yielded was these impacts, the first-year impact for the large office, there was a high of .28 kilowatt hours per square foot, per year. The peak demand reduction, 3.88 times 10 to the negative 5 kilowatt hours per square foot, and the high TDV of 8.43.

I'd like to -- highlighted in red is the natural gas. There was no natural gas savings since it results in smaller fans, with less heat into the air stream, so that resulted in more gas for the heating cycle.

The same thing for the medium retail, the same trend with the heating results. We had higher savings, it was .43 kilowatts per square foot, per year. For the electricity savings, of peak demand reduction, 11.03 times 10 to the negative 5 kilowatt hours per square foot, and a high TDV of 13.99.

Now, both prototype simulations showed that Climate Zone 15 was the high performer.

There's a 15-year cost for the large office. So, high cost savings, again Climate Zone 15 being the high performer here of .76 dollars per square foot savings.

Medium retail, the same trend with Climate Zone

15 being the top climate zone.

So, incremental costs. So, the CASE Team used existing projects and RS means to calculate the cost of larger duct work for the lower static pressure. And they also used RS means to determine the decreased cost due to smaller motor size and fans.

Here's the results for medium retail. I'd like to note that both showed cost effectiveness in all climate zones.

And here's the statewide impacts in cost of this measure, using the projections of the impact analysis. So, it looks like gigawatt hour savings of 11.728 and 2.340, that's when you combine both prototype savings.

So, for proposed code language they would delete all of what's in Section 140.4(C) currently, with the exception to some of the variable air volume requirements for static pressure sensor location and set point reset.

They would delete or current total fan power index equation and this would be the new code language.

So, again, the trigger being 5 horsepower and up for fan systems. Supply fans, return, relief fans, exhaust fans, fan-powered terminal units and so on. So, they must comply with Option 1 or Option 2 in the following table.

There are exceptions to this requirement. The exceptions came out of 90.1.

And so, Option 1 and Option 2 here, one being for motor nameplate horsepower versus fan system brake horsepower. If you notice, the multiplication factors here are different than what's in 90.1. They're more stringent and that's because of the total static pressure that's allowed, or that's required by the ACM currently, since 2013. So, these factors were adjusted to accommodate that. It's about a 10 percent increase in stringency.

And here's the pressure drop table. The CASE Team -- what I have highlighted in red, the CASE Team recommended deleting this. They noted that, you know, this was more for process equipment.

However, the Energy Commission is expanding the scope to now cover hospitals and so this MERV 16 and greater might become applicable. So, I reinserted it back into the table.

And at this time, I'm available for questions on this measure.

MR. WICHERT: We do have one on the line. This comes from Laura Petrio-Grow (phonetic). She's asking about where the impacts of a fan system power model with the proposed air filter level, she believe it's MERV 11.

Is that correct?

MR. TAKAHASHI: Hi, this is Ken, from Integral Group, the CASE author. The proposed measure was assuming a MERV 9 filter as the base case. So, any additional filters would have the adjustment factor applied to it.

MR. WICHERT: Oh, Ken, can you repeat that? Adjust the mic really close, actually.

MR. TAKAHASHI: Oh, okay, sorry.

UNIDENTIFIED SPEAKER: So, these mics don't amplify, either, so can you speak up? They only can serve to let people on the phone hear you, but they don't help the audience at all.

MR. TAKAHASHI: Okay, I apologize. So, this is Ken Takahashi, the CASE Author. The base case was assuming a MERV 9 filter. And any kind of additional filters would be adding the -- the adjustments factors will be applied to any additional filters.

MR. ALATORRE: So, I wanted to make the point that both MERV 9 and MERV 11 would have the same adjustment factor.

MR. WICHERT: Unless there's anyone else online, I think we're done with the online comments.

MR. ALATORRE: Okay.

MR. PAYAM BOZORGCHAMI: All right, we're on to the next topic. And then, after this one we'll take a quick, one-hour lunch break.

MR. ALATORRE: So, we're doing transfer air, now. Okay, this measure is Exhaust Air Heat Recovery. Again, Ken, thank you for the CASE proposal.

A little background. Exhaust air heat recovery is currently not mandated under the Energy Standards. However, it is a compliance option. But it's only a compliance option of you have a dedicated outside air system. And under the right conditions it could yield energy savings.

However, this is currently a national requirement under 90.1 2016. Energy recovery systems are also rated under AHRI Standard 1060 and 1061. And they are listed within the AHRI Directory.

So, there's many different manufacturers and they come in either stand-alone or as an option on packaged systems.

The CASE Team did an analysis of what's currently in the AHRI Directory. So, there's 1,254 different plate type heat recovery ventilators and close to 3,000 wheel type.

The 90.1 requirement requires a 50 percent recovery efficiency, which means of the 1,254 plate type, 86 percent of those can comply with the 50 percent recovery. And similarly, 95 percent can comply using the wheel type heat recovery ventilators.

However, the CASE Team is recommending that we push for 60 percent and that had the most impact on the plate type, bringing what's available currently on the market down to 48 percent. A little less than half. But if you look at the wheel type, almost no impact on the availability of those systems.

So, here's an example certificate from AHRI. This is for a system that's rated for 12,900 CFM. If you notice, this one would comply with the 60 percent recovery, both heating and cooling.

The recommendation is for it to be the lower of the two. So, in this case 63 percent would be considered during cooling.

In the energy analysis they chose three prototypes, small office, medium office, and medium office with a lab. They did this to show the different HVAC types.

So, as I mentioned before, heat recovery ventilators come as an option on packaged systems, or they could be stand-alone. So, they chose an office, and an office with a lab that had significantly different exhaust rates, which I think covered a pretty good spread of where these systems could be installed.

Key assumptions in their analysis was they calculated the added static pressure using the ASHRAE power adjustment factors. And they also put into the simulation that the outdoor air intake will bypass the ventilator if it was in the right conditions to be in economizer mode.

What the simulation couldn't do, however, is accommodate the fan or the fan pressure, so they were not able to get the savings from bypassing the recovery ventilator and economizer operation. And they couldn't adjust the static pressure if they bypassed the heat recovery ventilator.

So, for those hours when it was economizing they were taking a hit on the fan energy.

So, this is the first year impact for the small office. It did not have any electricity savings and no TDV savings. A little bit on natural gas.

The 15-year impact, there was no TDV energy cost savings and no electricity savings.

For the medium office, with the VAV system, there was some savings TDV-wise in Climate Zones 10 through 15. And the 15-year impact showed energy cost savings in those same climate zones, 10 through 15.

When we got to the medium office with the lab that had higher exhaust rates there was more savings, this time Climate Zone 2, Climate Zone 4, and 8 through 15.

The same climate zones showed savings in the 15-year impact.

So, incremental cost. They used manufacturers' data and RS Means, and they included the cost of the bypass dampers, the control and labor to install the bypass. And they did it -- they did the incremental cost based on CFM.

Also, incorporating the heat recovery ventilator resulted in reduced capacity of the mechanical system. So, they calculated that impact. So, this is a cost per square foot reduction. And this shows that this measure is not cost effective for small offices, in any climate zone. It's only in Climate Zone 15 for the medium office, and only in Climate Zone 2 and 9 through 15 for the medium office with the lab.

So, the proposed code language, they propose amending Section 140.4, saying each fan system shall have a heat recovery system with the system supply air flow exceeds volumes the table. I'll show you the table in a minute. Then they point to the AHRI test, saying that the minimum heat recovery ration shall be at least 60 percent.

And here's the table. So, for systems without high exhaust rates, you know, they're not operating over 800 hours a year, it showed that it was cost effective only in Climate Zone 15 at the 60 percent recovery ratio and higher.

So, the red, what you see in red strikeout are my amendments to this proposal. For buildings that are 8,000 hours or more, it only showed cost effectiveness in 2 and 8 through 15, so I amended the table to reflect that and only to require 60 percent recovery efficiency and up.

So at this time I can take questions.

MR. WICHERT: There's no questions online at this time, unless anyone wants to raise their hand or speak up.

MR. GRACIK: This is Stefan, the CASE Author. I just want to make a quick comment that the CASE Team is exploring other sort of avenues for presenting the proposed code change requirements away from the table format. We've gotten a lot of feedback it's confusing. And as you saw, it was not actually updated with our analysis. It was sort of a place holder.

So, we're trying to come up with maybe a more clear method of presenting the proposed heat recovery requirements.

MR. ALATORRE: Okay, thanks.

So, also for consideration, and this is a measure that could be a candidate for a compliance option, if we took away the caveat of having it apply to dedicated outside air systems, and have it applicable to all other systems, maybe that can get a little more market penetration. People wanting them to model it.

But, yeah, we look forward to the revised code language proposal.

MR. PAYAM BOZORGCHAMI: So, it's 11:00. I think we can take maybe an hour and a half break. And then come back at 12:30 and continue the rest of the afternoon. Some of you may have seen the schedule and may be more interested in the afternoon topics, and may not -- our schedule's way ahead.

MR. ALATORRE: Okay.

MR. WICHERT: And this is being webcast and recorded.

MR. PAYAM BOZORGCHAMI: This is being webcast, yeah, and it's being recorded.

(Off the record at 11:00 a.m.)

(On the record at 12:30 p.m.)

MR. WICHERT: Welcome back, everyone. We'll be starting the workshop shortly.

(Pause)

MR. ALATORRE: Are you ready, Payam? Okay, welcome back.

All right, we're ready for the next topic, Transfer Air for Exhaust Air Makeup. I'd like to acknowledge the CASE Authors for this measure, Jeff Stein from Taylor Engineering, and Stefan Gracik and Matt Dahlhausen from Integral Group.

The background on this topic, this measure has been adopted by ASHRAE, in their 2013 update. And it applies to spaces that have exhaust airflow rates that are greater than the heating or cooling airflow requirement to satisfy the load.

This proposal would eliminate the practice of providing 100 percent outside air or 100 percent supply air to satisfy the exhaust rate when you can use transfer air, instead.

It's common practice, and here's an example, a toilet room with a VAV box sized to match the exhaust, CFM requir3ed to meet the heating and cooling load or ventilation requirement much smaller than the exhaust rate. It's more efficient to only provide enough supply air to accommodate the cooling load and then use the transfer air to make up the rest of the exhaust requirement.

So the payback for this measure is immediate because it reduces both first cost and energy cost compared to supplying 100 percent of the supply air to spaces with high exhaust rates.

And, currently, there's no limitation, either mandatory or prescriptive, on the amount of air to supply. So this, similarly in the standards, in the covered process section we have a requirement for commercial kitchens to basically implement what this proposal is asking for. And so, we're going to expand this requirement to all spaces.

In the energy analysis, the prototype that was selected was a medium office and laboratory, because of the high exhaust. The lab spaces are exhaust-driven, meaning that there's a higher exhaust rate than there is a cooling air flow requirement. So, the medium office lab is sized to this tier, 53,628 square feet, 3 stories.

So, the energy savings from this measure depend on the benefit of reducing outdoor air intake. So there it is, by climate zone, so the energy impact and cost effectiveness were evaluated by climate zone. So, here are the results for the first year impact. You have an electricity savings high of .412 kilowatt hours per square foot, per year. A peak reduction high of 8.52 times 10 to the negative 4 kilowatt hours per square foot. And a TDV savings high of 15.11.

And like most other ventilation measures, Climate Zone 15 is the high performing situation due to the high heat.

The 15-year cost savings per square foot. Again, see an electricity savings high of $1.03 for Climate Zone 15. We have some natural gas savings in Climate Zone 1, which is the high performer there. With the TDV saving high of $1.34.

So again, since this measure reduces first cost it has an infinite benefit to cost ratio since there's no incremental cost.

The statewide savings, you know, this is projected based on the forecast. It looks like we have a gigawatt hour savings of .403, and a megawatt reduction of .854 megawatts.

So, for the proposed language, this would add a new section to 140.4, creating Section O. And it would state that the exhaust system transfer air, conditioned supply air delivered to any space with mechanical exhaust shall not exceed the greater of the supply flow required to meet the space heating and cooling load, the ventilation rate required by the AHJ, or the mechanical exhaust flow minus the available transfer air for conditioned spaces.

It also adds this, for the finding of available transfer air, it's the portion of outdoor air ventilation that is not required to satisfy other exhaust needs, is not required to maintain pressurization of other spaces, and is transferrable according to applicable codes and standards to the class of air recirculation limitations of the Mechanical Code.

So, in the Mechanical Code it lists the type of air, but depending on where it's coming from and, you know, only air, I think, deemed Class 1 or 2 can be transferred.

So, there's a list of exceptions here for the different spaces that this measure would not be applicable to.

Also, the CASE Team is recommending that we apply this to all other covered processes, that they use transfer air where available.

Note that this would not be a requirement for additions and alterations. We're still -- we have not made code changes, where in the process of doing that, but the intent is to not require additions/alterations to have to comply with this requirement.

And with that, I'm up for questions. First off, is Jeff Stein on the line?

MR. STEIN: Yeah, Mark, I'm here.

MR. ALATORRE: Thanks Jeff. So, we are all available for questions, now.

MR. WICHERT: We've got one question, the Q/A on the PM 2.5. "Will Title 24 the PM 2.5 related zip codes, so stakeholders fully understand where PM 2.5-specific measures will be implemented?"

MR. ALATORRE: I think that's in relation to a different topic, the ventilation topic. Our recommendation was that we were not going to specify that. We were going to require MERV 13 across the State and not get that granular as far as having, you know, the State broken out by zip code or what have you.

But that's not accompanying this proposal.

MR. PAYAM BOZORGCHAMI: The caller that asked about the indoor air quality that PM 2.5 (inaudible) -- would like to have the transcript for June 6th. I think your questions will be answered there.

MR. WICHERT: So, if there's no more questions online, I think we can move on.

MR. ALATORRE: Okay, moving along to the next topic, Demand Control Ventilation for Classrooms. Acknowledging the CASE Authors, the same as the previous measure, Jeff Stein, Stefan Gracik, and Matt Dahlhausen.

The background on this measure, carbon dioxide-based DCV has been used in the industry for over 30 years. It's been a mandatory measure used for classrooms in 90.1, since ’99. And since its induction into ASHRAE, they’ve continually reduced the space density trigger for when DCV’s been required. Currently, now, it’s down to 25 people per 1,000 square feet.

In relation to California’s Title 24, it’s been an option or recognized as a design criteria since ’92, and mandated for high-density spaces in 2001. And at that time it included classrooms.

During the 2005 update to the standards classrooms were taken out of the mandatory requirement, they were given an exemption.

From what I know, the reasoning for excluding it was there were concerns about sensor reliability and they felt classrooms was not -- they wanted to safeguard against classrooms.

However, given that CO2 based DCV have been around and is highly used in California and nationally, improvements have come with sensor reliability, as well as reduction in costs.

So also, the CASE Team contended, in the Case Report, that spaces that implement CO2 based DCV actually achieve better indoor air quality. And the reasoning being that the communication controls can sense when you’re not getting adequate outside air, which isn't the case without DCV.

Again, because of the healthy industry of CO2 and DCV, there are many manufacturers of stand-alone sensors. And many building automation systems, they offer CO2 sensors imbedded into their thermostats. However, not all CO2 sensors are created equal, there's different types. And there should be care by the designer on which one's specified. Some are not practical for 24-hour facilities, while others are. Some of that is outlined in the CASE Report. I'm not going to get into that detail here.

The proposed code change is to amend Section 120.1(c)3 to apply to more spaces, including classrooms. And also add the following, modulating outside air control and design outdoor airflow rate greater than 3000 CFM as triggers for demand control ventilation. And making these changes would align with current 90.1

So, for the energy analysis the CASE Team chose to prototypes. Since this measure is primarily focusing on schools, they chose a small school and large school prototype.

No changes to the model, other than adding demand control ventilation. And that yielded the following, this is the first year impact for the small school. It looks like the high of .73 kilowatt hours per year, a gas saving high of .06 therms per year. A peak reduction high of 2.9 times 10 to the negative 4 kilowatts. And a high TDV savings of 36.30. Again, Climate Zone 15 being the outlier there.

For the large school, the same thing, Climate Zone 15 had the electricity savings high. But on a TDV basis it looks like Climate Zone 11 outperformed them.

The 15 year costs per square foot, we had an electricity savings high of $3.05 per square foot, a natural gas savings high of $.99. The total energy cost savings of $3.23 per square foot. This is for the small school.

Similarly, for the large school, a savings high of $1.35 for electricity, $.97 for gas, and $1.74 TDV.

For the incremental costs, this was done using manufacturer data and RS Means, and also included a contractor cost for adding the demand control ventilation. The contractors indicated an average of $216 per room in incremental cost for adding the CO2 sensors.

So, there’s the same for the large school. If you see, it yielded benefit cost ratios across all climate zones, making this -- they were all great in making this measure cost effective.

So, on a yearly basis we got an electricity savings 2.525 gigawatt hours. I think at the end, I sum them up at the end.

So, anyway, this is the small school savings, the large school savings, totaling 3.34 gigawatt hours saved and totaling a 2.169 megawatt hour reduction.

So, for the proposed code change, here's the language. It would delete what's currently in Section 120.1(c)3 and it would change the language to these triggers, rather than the previous one.

So, it's the same, 25 people per 1,000 square feet, but the triggers would be an air economizer, modulating outside air control, or design control airflow rate greater than 3,000 CFM.

If you look at the exception, it removes classrooms and other spaces from being exempt, but it adds exemptions that, basically, these exemptions come out of 90.1

So with that, I'm available for questions.

MR. WICHERT: Is there anyone online who would like to make a comment or has a question? If not, I think we'll be moving on to the next presentation.

MR. ALATORRE: Okay, the last topic for today, Occupant Sensor Ventilation. Acknowledging the same CASE Authors, Jeff, Stefan and Matt.

Background on this measure, occupant sensor ventilation control was introduced under the 2013 California Building Energy Efficiency Standards update. It was in response to ASHRAE’s 62.1 Standards Committee coming up with an addendum that would allow certain spaces to go to zero ventilation when unoccupied. That addendum was not finished in time for the 2013 update, therefore, we did not pursue it completely. But there was some occupant sensor ventilation control requirements added in 2013.

So, those being that the following spaces need to comply with occupant sensor ventilation control. They did allow for the system to go to a reduce rate. However, it wasn’t completely turned off. They needed to provide an average of 25 percent of the ventilation rate over 2 hours. And it was only applicable to multi-purpose rooms less than 1,000 square feet, classrooms over 750 square feet, and conference auditoriums and meeting center rooms greater than 750 square feet.

In the meantime, the 62.1 Committee did get it passed and they defined occupied standby mode, which is when a building space conditioning zone is scheduled to be occupied, but the sensor indicates that no one’s in the zone.

And currently, ASHRAE 90.1 has approved a proposal that will require that demand control ventilation using occupied standby mode, but it's currently out for public review.

So, occupied standby controls require an occupant sensor to communicate with the thermostat or building automation system. Because occupant sensors have been required for lighting controls, there's a wealth of options out there and available in the market. And the proposal is only affecting spaces that currently require an occupant sensor from the occupant requirements. So, this wouldn't add the cost of a new sensor, it would just -- the sensor's already required because of the lighting control requirements.

So, the proposed change proposal, it is required to completely shut off the ventilation rather than maintain 25 percent over 2 hours. And it also modifies the space types where it's applicable to.

The key change that I would like to highlight is it would not be applicable to K through 12 classrooms. So, that would be an exempt space. And that's to reflect the requirements of ASHRAE 62.1 that does not allow elementary schools or K through 12 classrooms to be one of the occupied standby mode zones.

MR. GRACIK: Hi Mark, this is Stefan, one of the CASE Authors. I'm sorry to interrupt. I just wanted to mention that as far as K through 12 classrooms, we're considering trying to include them and moving away from 62.1., but I don't believe -- we're still working out the details as to how to do that and how to still -- as there are other proposals that involved 62.1 into Title 24. So, we're figuring how to resolve that.

MR. ALATORRE: Okay. Additionally, aside from mandating specific zones to be part of the occupied standby zone, they're recommending that the following be included as compliance options. That would include what's listed on the slide. These are zones that are allowed under 62.1 to be in occupied standby mode.

For the energy analysis they chose the small office and they made tweaks to the interior zones. A small office typically has a core zone, with four perimeter, and they added a conference and closed offices.

To go back to the prototype, so the baseline prototype for this measure would -- the way they simulated the occupant sensor requirement, they would turn the HVAC system off for 15 minutes every hour to maintain the 25 percent ventilation rate.

And the proposed design, the HVAC was turned off for the whole hour.

Another thing that was key was the assumption for occupancy, schedule occupancy. And the occupancy recommendations, or the ones that were assumed are highlighted in the CASE Report and also in the appendix of the report, with much more detail than I'm going to get into in this presentation. I recommend that people who are on the call pick up the CASE Report and look through that, so they can get an understanding of the assumptions made there.

The first year impact showed that there was an electricity savings high of .27 kilowatt hours per year. A natural gas saving high of 9.10 times 10 to the negative 3 therms per year.

Peak demand reduction, 2.05 times 10 to the negative 4 kilowatts. And energy cost savings or TDV savings, it looks like the high was 9.31.

So, 15 year impact. An electricity high savings of .77, a natural gas saving high of .16. Total energy cost savings of .83.

So, for cost effectiveness, the incremental cost, this was done by contractor quotes. That they interviewed. Let's see, how many -- let's see, based on the interview they said that it was $100 average per room. So, for seven rooms, on a 5,500 square foot building, it came out to $.13 incremental cost per square foot.

They also assumed that there was another $.13

over the 15-year life of a replacement sensor and controls. Actually, it was $.13, it was 12 and a half cents. So, combining the two, you get a $.25 incremental cost.

Comparing that to the energy savings, you've got benefit cost ratios as shown, showing cost effectiveness in all climate zones.

The statewide energy and cost impacts over the life -- or, not over the life, but the impact. It looks like we've got a gigawatt hour savings of 2.536 and a demand reduction .598.

So, going into the proposed language, this would amend Section 20.1(c)5. And it would eliminate the requirement in C, D and E. Those would be the reduction of the airflow rate and maintaining 25 percent over the 2 hours.

The main requirement would be put into 120.(e)3, replacing (e)3 with the following. So, zones serving only rooms that are required to have an occupant-sensing light control per the lighting control requirements and where Table 120.1.A, which we are recommending a different proposal to adopt ASHRAE tables, ventilation tables. Occupancy category permits the ventilation air to be reduced to zero when the space is in occupied standby mode.

They had some recommended deletions of certain exemptions and that's because they were no longer applicable.

They also wanted to add the definition for occupied standby mode in Section 100.1.

MR. GRACIK: Hey Mark, this is Stefan, one of the CASE Authors.

MR. ALATORRE: Stefan.

MR. GRACIK: I just want to point out that there's a --

MR. WICHERT: You have to get very close to the mic, like very close.

MR. GRACIK: This is Stefan, the CASE Author. And I just wanted to point out that there's a few pieces that are in flux in this code measure language. So, what it ultimately is proposed is the draft may be slightly different than what's shown here, but for the most part it's the same.

MR. ALATORRE: Okay, thank you.

So, with that, I as well as the CASE Authors, we're available for questions.

MR. WICHERT: There is one thing. There are some questions -- I don't think the audience was able to hear your first comment. And I don't know if you could repeat that for clarity, there's some question.

MR. GRACIK: Hi, this is Stefan, the CASE Author, or one of the CASE Authors for this measure. And there was a question about what I said earlier and it was just that the exception of K through 12 schools that was written for the previous measure, the demand cooled ventilation. We're considering removing that from the exception -- we're considering removing that as an exception and adding K through 12 schools, along with the rest of the classrooms as a space that requires demand controlled ventilation. I just wanted to mention that we're thinking about that.

There are some issues since ASHRAE 62.1 does not allow that, so we are working to resolve how we would sort of put that piece into it, while still considering adopting 62.1 in a separate measure.

MR. PAYAM BOZORGCHAMI: This is Payam, real quick. The report's already posted on the website, so more details on that, please review that report -- It's actually on the top24stakeholders.com website.

Well, if there are no more questions, then this --

MR. ALATORRE: Do we want to do that Q/A, RJ, to see if anybody had questions about previous presentations?

MR. WICHERT: There is one Q/A from a previous presentation that I can read off, if you're ready for it.

This is from Ben Doldich regarding, "For data center applications what consideration has CEC made for new ASHRAE 90.4 energy standard for data centers and use of NLC calculation instead of water economizer. If none, why not and when?

MR. ALATORRE: I think that question was posed during the previous presentations and the answer was we don't -- we're not actively maintaining or keeping an eye on 90.4, we're not required to. We are required to consider 90.1, however, and so that's why.

When? Again, I don't think we're going to be pursuing changes to 90.4 at this time. It's just not something in our scope.

MR. PAYAM BOZORGCHAMI: So, if there's no more questions in the Q/A session, this ends our PreRulemaking Workshop for today.

We'll be here again on Thursday, June 22nd, here at the Energy Commission for the Nonresidential Lighting Measures.

For all the measures that you heard today, comments are due to the Commission website, as you see on Mark's presentation right there, by June the 7th -- excuse me, July 7th, I'm sorry. Making sure that everyone’s awake. And I’m not.

And the presentations that you heard today are going to be posted by tomorrow, on our website.

Thank you.

(Thereupon, the Workshop was adjourned at 1:04 p.m.)

--oOo--

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.

And I further certify that I am not of counsel or attorney for either or any of the parties to said hearing nor in any way interested in the outcome of the cause named in said caption.

IN WITNESS WHEREOF, I have hereunto set my hand this 8th day of July, 2017.

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Eduwiges Lastra
CER-915

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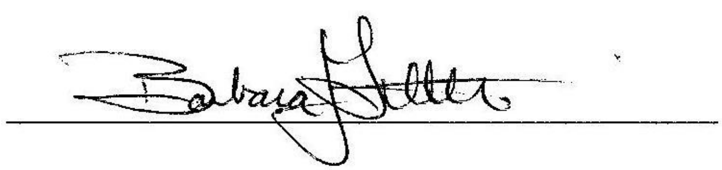
I do hereby certify that the testimony in the foregoing hearing was taken at the time and place therein stated; that the testimony of said witnesses were transcribed by me, a certified transcriber.

And I further certify that I am not of counsel or attorney for either or any of the parties to said hearing nor in any way interested in the outcome of the cause named in said caption.

IN WITNESS WHEREOF, I have hereunto set my hand this 8th day of July, 2017.



Barbara Little
Certified Transcriber
AAERT No. CET**D-520