DOCKETED	
Docket Number:	19-BSTD-03
Project Title:	2022 Energy Code Pre-Rulemaking
TN #:	235958
Document Title:	Transcript for 10-13-20 Public Workshop
Description:	This file is the transcript of the public workshop held on October 13, 2020.
Filer:	Peter Strait
Organization:	California Energy Commission
Submitter Role:	Commission Staff
Submission Date:	12/16/2020 11:05:21 AM
Docketed Date:	12/16/2020

STATE of CALIFORNIA

STATE ENERGY RESOURCES CONSERVATION and

DEVELOPMENT COMMISSION

In the matter of:	)	Docket No. 19-BSTD-03
	)	
2022 Energy Code	)	STAFF WORKSHOP
Pre-Rulemaking	)	
	)	
	)	

STAFF PRESENTATIONS ON:
Multifamily Restructuring, Multifamily Domestic Hot Water Distribution and High-Efficiency Boilers

Remotely held via Zoom

California Energy Commission
Warren-Alquist State Energy Building
1516 Ninth Street
Sacramento, California 95814

Tuesday, October 13, 2020

Reported by:
S. Palmer, CERT 00124

APPEARANCES

From the California Energy Commission:

Amber Beck
Payam Bozorgchami, Host
Haile Bucaneg, Co-Host
Javier Perez, Co-Host, Presenter
Mazi Shirakh
Peter Strait, Co-Host, Presenter
Danny Tam, Co-Host, Presenter
Will Vicent

Panelists:

George Chapman
Matt Christie
Danuta Drozdowicz
Alea German
David Krause
Elizabeth McCollum
Cheng Moua
Gwelen Paliaga
Mary Trojan
Julianna Wei
Heidi Werner

Attendees:

Mark Alatorre
John Barbour
Sally Blair
Scott Blunk
Liszet Burgueno
Marc Connerly
Shannon Corcoran
Scott Criswell
John Cullum
Tom Culp
Kelly Cunningham
Bill Dakin
Erica DiLello
Sid Dinwiddie

APPEARANCES, continued

Attendees:

Amy Dryden
Amir Ehyai
Luis Garcia
Martha Helak
Mike Hodgson
James Kemper
Kim Kendzel
Karen Kristiansson
Jim Lutz
Shawn Martin
Gordon Maynard
Steve McCool
Jon McHugh
Stephen Memory
Sean Morash
Chris Olivera
Shar Moaddeli
Tom Paine
James Qaqundah
Josh Rasin
Tim Rooney
Hugo Schmidt
Simon Silverberg
Rob Starr
Nehemiah Stone
Meg Waltner
Shaojie Wang
RJ Wichert
Allen Wong
Daniel Wong
Nick Young

I N D E X

P R O C E E D I N G S

OCTOBER 13, 2020 9:05 o'clock a.m.

MR. BOZORGCHAMI: So good morning, everyone. My name is Payam Bozorgchami. I'm the Project Manager for the 2022 Building Energy Efficiency Standards. I want to welcome you to the Energy Commission's Virtual Pre-Rulemaking Workshop for the 2022 Energy Standards.

And let me provide you with some housekeeping rules. We will be muting everyone. And after each proposed measure is presented, you can raise your hand and we will unmute you or you can submit your question in the question and answer window, and we will read them out loud and try to answer them as they come in.

If you're on the phone, you can use the star 9 to raise your hand and star 6 to mute and unmute yourself. One important thing to remember is that when unmuting, when we do unmute you, please state your name and your affiliation. This is very important as this presentation and this discussion is being recorded and there will be a court reporter on hand and this workshop will also be transcribed. And we will have the postings on our docket later on.

So, again, when we unmute you, please state your name and affiliation. I will stop you, and apologize right now, I will stop you and ask you to do so, just to make sure that it's on record.

So with that, let's start the presentation. What we're going to be going over today is some basic background how Title 24, Part 6, the Energy Code was developed. Javier Perez, a Mechanical Engineer within our office, will be going over the Multifamily Restructuring. And Danny Tam, one of our Mechanical Engineers also here at the Building Standards Office, will be discussing Multifamily Domestic Hot Water Distribution High-Efficient Boilers for today.

And, with that, I will start with the quick description of what's going on here at the Energy Commission and some time lines.

So to reduce wasteful and uneconomic and inefficient and unnecessary consumption of energy, two California Assemblymen Warren and Alquist developed what's known as the Warren Alquist Act. It was signed into law in 1974 by Governor Ronald Reagan and funded by Jerry Brown in 1975. And this started what's known as the California Energy Commission.

What the Warren Alquist Act does is it gives authority and it gives authority to the Energy Commission to develop the Energy Code on a triennial basis and local jurisdictions to enforce the Energy Codes through the building permit process.

As codes are developing there is more and more that's happening. And recently there has been more emphasis

not just on energy efficiency but also on greenhouse gas reductions. There's been goals on electrification and how to reduce residential and nonresidential building impacts on the electricity grid. We've been trying to promote flexibility and self-utilization of PV generation and provide tools for local government Reach Codes. Those are the county codes.

So how do we develop the codes? Recently with the assistance from our public utility partners, being Pacific Gas & Electric, Southern California Edison, San Diego Gas & Electric, the Sacramento Municipal Utility District, and the Los Angeles Department of Water and Power, we have -- with their assistance we have been developing the triennial codes. And recently the California Energy Alliance has also been partnering up with the Energy Commission and providing measures and proposals to us to review and evaluate for 2022. Also there is a private entity named Vertiv has also submitted a proposal to the Energy Commission.

But what the utilities have done so far, they have had stakeholder meetings. They have submitted their proposals that they're going to be -- shared their proposals with the public prior to submitting them to the Energy Commission for review. And what they have tried to do is they have really tried to capture all the comments and concerns early on and address them in their CASE Reports,

the Codes And Standards Enhancement, Reports, so when it does come to the Energy Commission and that we have these workshops, we have taken care of a majority of those concerns.

All the measures that are presented have to go through a life-cycle costing methodology. These are the most-recent time-dependent value equations.

Our schedule. This is a high-level schedule of what's happening here at the Energy Commission with our standard schedule for adoption. Right now in the August-October era, Energy Commission staff is reviewing reports submitted to us. We're having these workshops and pre-ruling workshops here. And after that we are supposed to develop the 45-day language. And then we will be presenting those in February. The date is not set yet. There will most likely be three or four workshops. Those will be commissioner-held workshops at the Energy Commission of the proposed measures that will go into adoption by the commissioners in July of 2021.

After that, staff has developed the peer software programs to update those. We have developed the compliance manuals. We have developed the electronic documentations needed for compliance. And then we vote for approval for these manuals in December of 2021. And we at the same time we go to the California Building Standards for approval of

our measures and proposals later in 2021 also. It will be roughly about November to December, depends on when they're scheduled with the Building Standards Commission. And what that does, it gives pretty much all of 2022 for you folks to be trained to understand what's going on, to provide guidance, and allow people to really get a grasp of the standards before they go into effect in January 1st of 2023.

So with that, there has been a lot of work that's happened so far. We've had quite a few pre-rulemaking stakeholder workshops. All these workshops, the PowerPoint presentations are posted on our docket. The transcripts are posted on our docket. If you're interested, you are welcome to go and review those. And there's comments submitted to our docket that you are also welcome to review.

Right now being October 13th, we will mostly likely have -- one, two, three, four -- five more workshops coming up. Our last one will be on November 19th. That will be on the Full Proposal on Electrification of Building Types. We're looking at how to begin to get PVs and storage right into the Standards.

How you can also keep up on what we're doing is the Title 23 Utility Sponsor Stakeholders, they have a website where they have all the documents that they have looked at and reviewed, the comments that came to the utilities regarding the proposed CASE reports submitted to

the Energy Commission. Then we have our website that has all the Title 24 for 2019, 2016, and what we're doing for 2020. These are all the manuals, the computer software programs, the Standards, the Reference Appendices, and so forth.

Our comment log. From today's workshop and any other workshop, we would like to have your comments -- for this workshop in particular by August -- excuse me -- October 27th, submitted to this docket here. This is one of the most important links in this PowerPoint presentation and you will see it more and more as we move forward from one presenter to another. Your comments, your concerns, support or opposition need to be submitted here. You could also -- within this docket, you could also see what's being presented. This PowerPoint presentation will also be docketed here, so that will be done by tomorrow noon. And this is a very key, important weblink.

Key staff members here at the Energy Commission Building Standards Office: Mazi Shirakh, and most of you probably know already by now. He's our technical lead again on what we call now not electrification but heat pump ready; myself, program Manager for the Building Standards; Larry Froess, he's our CBECC software lead; Peter Strait, he's our supervisor over staff of the Building Standards Develop team; Haile Bucaneg, he's new to this code cycle to us, he's

a Senior Mechanical Engineer, he's been very helpful and very active in helping review the reports and proposals and providing comments back to the authors; and Will Vicent, he's our new Office Manager, he's in his third week here at the Energy Commission. That's his email. I don't have a phone number yet for him because we have not been back in the office yet. But if you have any issues with any of us, he is the person to communicate with.

Again, like I said, you will see this link, you will see this due date over and over again throughout today's presentation. Please submit your comments before October 27th. The earlier you submit them the earlier we can start working and reviewing and making edits to the Standards. We really don't have much time. With everything that's been happening this year in 2020, with the COVID and with working from home, we're running out of time to really get a Standard. Unfortunately, the finish line, the date, is not going to change on us. But the only thing it's going to do is it's just going to cut our schedule short.

So with that, any questions?

If there are no questions, I will thank you. And Javier Perez will be presenting on the Multifamily Restructuring.

Javier.

MR. PEREZ: All right. Are you able to see my

screen?

MR. BOZORGCHAMI: Yes.

MR. PEREZ: All right. And sounds like you can hear me okay, so good deal. My name is Javier Perez. I'm with the Outreach and Education Unit, I'm an Energy Commission Specialist in the Building Standards Office here at the Energy Commission. And, as was mentioned, I've been here over 12 years now, since the 2005 code cycle. I've definitely seen things change a lot and I'm happy to be presenting the Proposal for the Multifamily Restructuring for 2022. I definitely want thank the CASE authors for their efforts here, Elizabeth McCollum, Matthew Christie, Julianna Wei, -- and I apologize if I pronounced that wrong -- Alea German, and Nehemiah Stone.

This is a huge undertaking. You know it involves relocating a lot of measures and trying to unify the code across low- and high-rise multifamily, and really involves some kind of innovation and creativity to get to where we want to be. I think there has been a lot of industry efforts or recommendations to simplify the code and maybe reorganize it in a way --

MR. BOZORGCHAMI: Javier, I apologize. This is Payam. Could you speak up a little bit or get closer to the mic a little bit?

MR. PEREZ: Yeah, is this better?

MR. BOZORGCHAMI: Sure.

MR. PEREZ: Okay. I'm going to keep going and let me know if this is not good.

So, yeah, there has been a lot of push to reorganize and make the code a little bit easier to navigate. And this is probably one of the first efforts that we have in doing that. So without further ado, let's get going.

Okay. So there are two kind of categories for this restructuring. The first one is really just relocating language. you know we've got language pertaining to high-rise residential located in the nonresidential section. And then we've got language pertaining to low-rise multifamily located in the low-rise section.

So primarily the focus there was just to move all of those sections and the language into new subchapters at the end of the Energy Code. And then from there, where cost-effective and where appropriate, apply the more stringent requirements across all low-rise and high-rise multifamily buildings, hopefully increasing uniformity and simplicity. You're going to find that's a challenging thing to do. These buildings can be very different and finding a cost-effective way to meet these measures can be cumbersome. But you know the CASE team did a great job of trying to find creative solutions, and we'll definitely see where the chips

lie. Without that work we wouldn't know what, you know, we could or should do moving forward, so it was definitely a lot of work that will give us good direction with the 2022 Code.

So with regards to restructuring, and this is just really about reorganization, right, we've got requirements for high-rise res in Subchapters 3 through 6, including mandatory prescriptive performance and additions and alterations. And for low-rise res, primarily Subchapters 7, 8, and 9, again mandatory prescriptive, additions, alterations. All of those have been relocated and reproduced into new subchapters, Subchapters 10 through 12. And this is going to be strictly multifamily building subchapters.

This is a significant change. You know in my time at the Commission, I don't know that I've ever seen the code get thinner, and I don't think that this will produce that either, right. Again one of the drives here, and if you guys were part of the 2013 or '16 code cycle, you may remember Greg Mahoney out of the City of Davis who was pushing for restructuring and reorganized, and really had some valid concerns about, you know, the necessity to jump around to find section requirements for maybe a water hearing alteration or something that could be as simple as that. So this is our first effort at trying to make that

more of a streamlined process to figure out what the -- but again this is strictly multifamily buildings, whether low or high.

So I'm not going to bore you too much with, you know, what that looks like and how that language was reproduced. I encourage you to check the CASE report and see how that language was relocated. Again, there's going to be a lot of duplication of requirements because a lot of the things that are applicable to low-rise single family are similarly applicable the low-rise multifamily. So you will end up seeing again a lot more pages, but hopefully this will be a scenario where more pages means an easier code to understand and comply with.

So these are the prototypes that the CASE team used for the multifamily, kind of justifying energy savings, cost-effectiveness in the four different types: Two-story, three-story, five- and ten-story. Depending on the height, obviously it got a lot bigger. Square footage, some assumptions are there. You know, I'll let you read them, and I don't really want to bore you with too much of that detail. Just understand this is how they created kind of a foundation for determining the efficiency or the -- yeah, efficiency, cost-effectiveness, energy savings, and in some instances you're going to find energy losses with the changes that are being proposed as part of this proposal.

And a couple more for windows and for existing buildings, they had a few variances here, and that's what's listed. I do want to emphasize that this is part of the draft. You know, this is the first crack at moving this thing forward. You know, this is isn't set in stone by any means. An introduction that we're hoping to get participation, whether on the conference today, call today, or in writing. You know, if you do it over live right now, you will put me on the spot, but we'll try and figure it out. At worst case, we'll get back to you in writing. And we have the CASE team on the call also, so I may end up deferring to them as necessary.

So for weighting purposes, this is the weighting. You know, probably the more common building in new construction, the five-story mixed-use building is the one that's weighted the heaviest. And we'll see some variances between two and ten, and getting down to four and five percent. And for alterations or for existing buildings, you see a little heavier on the two-story and then almost equal distribution across the rest of the buildings.

Okay. Let's jump into the Envelope Unification Measure Proposals. And the two things that I want to put emphasis on are on the unification component, and these are proposals, you know. We'll see where we go. We'd love to hear your feedback. And the whole point of this was to try

to merge these requirements and where cost-effective, where technically feasible, make them the same. And maybe where they're not, get some feedback, see what industry thinks, and take it from there.

Okay. So we're going to start with roofing products in low-sloped roofs. The intent on this measure was to apply the more stringent prescriptive requirements where cost-effective and reasonable. All of our roofing product requirements are prescriptive, they're not mandatory, so for that reason they're all prescriptive.

So, in short, the buildings are three habitable stories or less, the 2019 code does not have efficiency measures for low-sloped roofs in Climate Zones 9 through 11 and 14, so we're going from 0 to 0.55, and increasing thermal emittance in the same climate zones from 0 to 0.75. Now we're definitely hoping to get your feedback on this. We're not set on any of these. Again, this is where we landed with the report.

Buildings taller than three habitable stories increased and aged solar reflectance went from .55 to .63 to match those of the lower buildings. And it's important to note that in this scenario low-rise res had a higher efficient requirement. And you will see how this change actually didn't produce an increase in cost.

So first-year impact, the first two tables here

are the two- and three-story multifamily prototypes. You're going to find some energy savings on the far right. A lot of -- a lot of it is on the electricity side. Natural gas is going to increase a little bit. But overall your TDV energy savings are significant for those low-rise res because you are going from no roofing product requirement up to something that is -- does have a minimum efficiency.

Similarly, five- and ten-stories, you are seeing some electricity savings again. Ultimately, if you think about electricity savings and you think about reflectance on roofing products, you know, this is going to help with cooling demand and reduce that cooling demand for that reason, the electricity savings are significant. It's actually in scenarios where you have maybe ducts in an attic, which may not be as common in some of these multifamily prototypes. But in some scenarios if you have your ducts in your attic and it's really hot up there, cooling that temperature down will significantly help that HVAC system, especially on the cooling side.

Here's your cost savings over 30 years. Again you're losing some money on the heating because the heating system is going to have to run a little bit more, but you are saving a significant amount on cooling. You will find that across all the prototypes, whether it's low-rise multifamily or the high-rise multifamily.

Now as far as benefit-to-cost ratio, you know where we're landing. This is significantly higher. You know 1.0 is really the target. It pays for itself over 30 years. You know that -- that pays for itself, that's something we can requirement. That's the basics of the Energy Code's requirements. We can't require it unless it pays for itself, and you're going to find some scenarios where that can be a challenge.

Moving on to the five- and ten-story homes. This is a peculiar scenario. The efficiency for low-sloped roofing products is increasing from 0.55 to 0.63. Now the CASE team found there are products available that achieve this proposal at the same cost as products that meet 0.55 minimum aged solar reflectance. So for that reason, you know the incremental cost is at zero. If you guys are finding that this isn't the case, you know we'd love to hear that, but that's definitely the result of the research done by the CASE team, was that this incremental cost was not at all existing going from .55 to .63 -- there were products on the market that satisfies it.

Okay. Moving over to steep-sloped roofs, similarly applying the more stringent prescriptive requirement by slope and climate zone. You know, where cost-effective and where reasonable. For buildings that are taller than three habitable stories, we're removing minimum

age solar reflectance requirements in Climate Zones 2 through 9, and less than -- you know, one percent -- the CASE team found that less than one percent of these buildings have steep-sloped roofs. So it's a really small market. And there weren't prototype versions of these buildings available for this analysis, so moving away from that. And, again, it's a really, really small portion of buildings that are being affected by this change.

And continuing with the minimum aged solar reflectance for Climate Zones 10 through 15 and thermal emittance, no change. Those things already match. So that's a happy medium there.

A quick introduction to the roofing production unification requirements. Are there any questions? Many of those -- we've got probably ten measures to go through, so we built in questions here to try and address the questions within the subject category, if there are questions.

Payam, are you seeing any questions?

MR. BOZORGCHAMI: I am not. And I don't see any raised hands.

MR. PEREZ: Okay. All right, so we will continue on.

Up next we've got roof and ceiling insulation unification. Again, this target was to create uniform requirements across multifamily buildings and across

assembly types where the assembly types matched. For low-rise res, the max U-factor of 0.043 for ceiling or rafter insulation, and we wanted to apply that to multifamily buildings with attics, right, because that's an important delineation, and apply the nonres max U-factor of .98 -- to .098 for metal roofs across the board. I don't want to read all of these to you, but essentially applying the more restrictive where applicable and in some scenarios maybe less restrictive, if that meets in more harmony with these buildings.

Okay. So as part of this unification there are going to be scenarios where we will be increasing energy consumption in buildings. This is going to be one of them. You know Climate Zones 1 through 7 and 12 through 16, you're going to see some increase in efficiency -- I'm sorry -- in energy consumption, and then an increase in energy savings on the other end. So this table kind of says in a lot less words.

And this is something that we'd love your feedback on. You know we are -- we are trying to simplify the code and in simplifying the code, that means, you know, you have some overlap and you're trying to meet in the middle. And this is a scenario where we're decreasing efficiency in buildings, and in the name of making the code simpler and increasing compliance because the more complicated the code

is, I think -- you know, we're getting feedback that it can be challenging to implement and to enforce.

So this is one of the scenarios where, you know, I would -- I would think we would all love feedback on and, again, in writing would be great. In person right now would be great as well, but definitely we'd love feedback on rolling back some of these measures and hopefully increasing compliance and simplifying the code. Because, as you can see, there was a lot of red on the board and the red means you're losing energy savings in these climate zones.

Similarly, this is a three-story prototype. 2 and 3 are the ones that are losing energy savings as a result of these changes.

So since the unification of these measures does not increase stringency, there wasn't any cost-effectiveness. And, again, we're making everyone meet at a level that's lower for this scenario, and they only impact low-rise res construction that do not have any attic, so a very, very small portion of the -- the multifamily stock in new construction.

Any questions on these?

Payam, are you seeing any raised hands?

MR. BOZORGCHAMI: No.

Any questions?

If you don't have any questions or raised hands,

you can also submit your comments at a later time. So I think we should keep going.

MR. PEREZ: Good deal, okay. Okay. So we've got wall U-factor unification. Again, trying to create uniform requirements across multifamily buildings, but varying by assembly type and obviously by climate zone. I think if you know the Energy Code you know that we've got 16 climate zones. And some things don't calc out in Tahoe the way that they do in Fresno, so we've got climate zones for that reason.

So this is a significant change from the current Energy Code to this proposal. They're addressing insulation requirements by fire rating. The Building and Fire Codes have a minimum fire rating or minimum hour rates for walls, depending on proximities to next buildings and a few other factors. So for that reason it can be challenging to meet the Energy Code's current insulation requirements without increasing costs significantly. So variances in insulation would be to combine metal, and then when you get to framed, you've got -- depending on fire rating, if it's two or three hour you've got one insulation value. And if it's a lower fire rating, like zero or one hour, and all other wall types, then there is another value. And mass walls continue to have their own category.

Okay. So, like I said, the California Fire Code

has these restrictions and they vary by building size and proximity to neighboring structures. And these structures do have some challenges when insulation values get higher and the higher fire rating requirements also exist. So that added cost, that complicated construction methods, the thicker assemblies, limited options that made it prohibitive to meet the Energy Code's requirements. So, again, this is a scenario where the Energy Code -- or the proposal was that the Energy Code vary depending on these expectations and be a little bit more cohesive with the requirements of the other codes.

All right. So this is what the proposal will look like for insulation values. You will see that the most important variance here on the left-hand side is in the bottom where you have the two different ratings for framed walls. Whether it's high-fire rating or a low-fire rating, you will find that the U-factor requirements are a little bit different. You know, achieving .065 involves continuous insulation, and that's the highest number that you will see here. So prescriptively you're expecting continuous insulation along these walls. And the mandatory again varies similarly to the building code based off of framing, whether it's two by four and two by six, or nonframed, those numbers will vary.

For heavy mass this is what it looks like. Again,

climate zone dependent. Climate Zone 16, 8 to 16, think Tahoe, think snow, think the Grapevine. Anywhere where it's very cold, you will see insulation requirements that are significantly different than the other climates.

So as a result, right, if we're going to recognize that the Fire Code makes it more challenging to meet higher insulation values, then we're going to concede lower insulation requirements for high-fire rated walls, because the cost and difference. Complications that come with that, then there naturally are going to be energy losses, right. This is a scenario where, again, you'll see red across the board in climate zones where there are requirements or variances in requirements.

And that's just the result, but also the CASE team found that this is an appropriate place to land which, more importantly, because this is a public process and we'd certainly love feedback from industry, the little feedback that I've seen is that this is appropriate, and I don't know if it's appropriate to have variances based off of fire rating.

All right. So for low fire ratings, zero to one hour for five-story prototype buildings, you find energy savings practically across the board where there are requirements. Very different from the high fire rating where we were lacking requirements.

All right. Here is your first-year energy impact per dwelling unit. Not much to say other than again similarly you're seeing some losses her because of the reduction in energy efficiency. The same for the ten-story prototype. The same concept, the same idea.

Okay. So here is the incremental cost for the requirements of the CASE Team count. Give me one second. All right. So they got their cost data from RSMeans online. There is a lot of data here, but they just get it from RSMeans database. If you guys are seeing these costs as comparable to what you see in industry, it would be helpful to hear that. And if you're not, also that would be a benefit certainly, be helpful as well.

Okay. This is where we get into the cost-effectiveness of this measure, and this is where some of the creativity comes in and, again, where we'd love to hear your feedback. In some of these climate zones, the wall U-factor requirements weren't cost-effective by themselves. So, for example, Climate Zones 1 and 2, you can see a benefit to cost ratio of one point -- greater than 1, and then obviously in the other climate zones, it's not rating as well, right. That's 3, 4, 5, 8, 9, and 10, you will see the benefit to cost ratio is not greater than 1.

Now the CASE Team's proposal includes grouping of certain measures to achieve cost-effectiveness. So what

does this mean? They grouped this measure with what's coming next and with electrification of HVAC systems and combined those costs and benefits to achieve overall cost-effectiveness. At this time, I don't think we're going to be following that methodology. But, again, this is part of the creativity and part of trying to figure out what is cost-effective through this process. You know, in this scenario where it's not cost-effective, I don't believe at this time that we're going to be moving forward with any grouping to get these things calc'ed out. But I will present that option to you and let you see what was part of the proposal. And, again, your feedback would be more than welcome.

So time for that feedback. Anybody have any questions, any feedback, any comments on the wall U-factor unification requirement?

MR. BOZORGCHAMI: Javier, I don't see any raised hands or any questions in the question and answers, or any comments.

MR. PEREZ: All right.

MR. BOZORGCHAMI: So...

MR. PEREZ: All right. So we'll continue on. Thanks, Payam.

MR. BOZORGCHAMI: Javier, we just got one from Tom Culp.

MR. PEREZ: All right.

MR. BOZORGCHAMI: Just to clarify, does -- this does not apply to guestrooms in hotels, right?

MR. PEREZ: Yeah, that's correct. This is all about multifamily or R occupancies and R -- we have a definition for high-rise res, but if you look at the definition it says except or other than hotel/motel occupancy. So, yeah, certainly not. This is -- this is more about dwelling units than those transient types of buildings.

Any other ones?

MR. BOZORGCHAMI: Thank you, Javier.

MR. PEREZ: All right. Okay. So currently the 2019 Energy Code has QII requirements for low-rise residential buildings, which is buildings with three habitable stories or less. Part of this proposal includes extending QII requirements to multifamily buildings up to 40,000 square feet of total commissioned floor area intake. This is extending them to high rise, or buildings that are more than three habitable stories. Again, currently it's only applicable to multifamily buildings that are less than or equal to three habitable stories or single-family buildings of any kind.

Similarly, the addition requirements have QII requirements if the addition is over 700 square feet, and

the proposal is to expand that to across the board to high-rise multifamily or multifamily with more than three habitable stories.

Now QII is currently not applicable to alterations, and that will continue to be the case. Curtain wall assemblies, and the verification of those things was found to be a little bit challenging in developing protocols at this time was not something that seemed reasonable. So for that reason any curtain walled assemblies would be excluded from the QII measures.

Now the 2019 Energy Code found that -- the CASE Report found that QII was not cost-effective in multifamily buildings in Climate Zone 7. Continuing with that, the 2022 proposal will also not have QII requirements in Climate Zone 7. When you think about Climate Zone 7 think about coastal, San Diego, I think very mild, not too much high or low, with some partial variance in constant temperatures that would require heating or cooling.

Okay. So the current testing procedures weren't exactly a barrier. One thing that the CASE Team did find was that the number of visits could be challenging because these buildings are staged -- built in stages and back floor. So the number of visits would be a little bit different than with a single-family or a low-rise building where you could kind of check all of these things at one

time. So the current QII protocols rely on up to three visits for site verification and QII for the high-rise multifamily buildings, we would expect it to be higher. So that was one thing that was definitely a point to take from this measure.

Okay. So the current code does not apply. Current QII requirements don't apply to mid- or high-rise multifamily buildings. The proposed design assumes cavity insulation is derated by 30 percent for all climate zones except for 7, where QII again is not required and is not being proposed either.

So here is your table for energy savings for your first high-rise multifamily prototype to five stories. The energy savings across the board; again if we're assuming insulation is not derated after QII, then natural energy savings will occur.

For the three-story prototypes, this did have negative value. Give me one second. I don't have notes for why this was negative. Maybe during the Q&A, maybe Matthew Christie could speak to this table. I apologize, I don't have anything on my slide here.

Okay. So for the five proto- -- why five-story prototype building again naturally you're saving energy, you want to be saving money. Now ultimately what we need to get to is whether or not it's cost-effective. So incremental

first costs for QII, there was no additional material or installation costs. This is just having a third-party special inspector come out and verify that these measures were done accurately. On the right you will find the incremental cost for QII inspection per dwelling unit, which if this were single family you would think that's pretty low, but when you have a multifamily building distributing that cost, across those buildings it does reduce gas costs significantly.

And the rates for HERS labor was $80. Their estimate. Including markups or profit and overhead, if you have any feedback on that, if you think that that's not appropriate, please feel free to share. And it was 55 cents per mile for each visit and for those extra visits, and a lot more, but the report is really detailed. And I don't want to get into all of the details here.

So across the board you will see that cost-effectiveness was at least two or greater. In other words, the cost that it cost to do this measure was two times -- paid back two times, at least two times as much as it cost.

So this one was easily cost-effective. And it is a complicated thing, especially with high-rise multifamily getting those different steps in for verification. So if anybody has any questions, any experience on these measures or feedback, you know, whether it's submitting them for the

docket or right now, we'd be happy to take them.

No questions, Payam?

MR. BOZORGCHAMI: No questions, but do you want Matt to chime in on those QII --

MR. PEREZ: Yeah, if Matt was available, that would be helpful.

MR. BOZORGCHAMI: Matt, could you answer that question, please?

MR. CHRISTIE: I am, yes. This is Matt Christie. Can you hear me?

MR. PEREZ: Yes.

MR. BOZORGCHAMI: Perfect. Thank you, Matt.

MR. CHRISTIE: Excellent. Yeah, so those negative savings on the chart that you showed are for the large low-rise buildings, so buildings that are over 40,000 square feet of conditions floor area but on the three habitable stories or fewer, and therefore aren't subject to QII anymore under the proposal.

MR. PEREZ: Got it. Okay. Thank you. I appreciate that.

All right, well, if there are no other questions we will continue on.

Okay. So fenestration properties, and this is for new construction. This is another one of the measures that was grouped as part of demonstrating cost-effectiveness.

And, again, we'd love any feedback that you have. I don't -- as of right now, we're going to move forward with anything that's not effective on its own, but again any feedback would be greatly appreciated.

So the goals again with a lot of these things was to create uniform requirements across multifamily buildings on the scenarios based on of fenestration type.

So mandatory measures. Currently, the low-rise residential standards require a maximum U-factor, a weighted average U-factor of 0.58, whereas the multi or the high-rise or the nonres side has no mandatory requirements. So that was something that they wanted to move towards a mandatory requirement across the board, though to exclude curtain wall fenestration types.

So prescriptive measures. There would be two categories moving forward: Curtain wall and then storefront windows, and apply the more stringent requirement where applicable. For all other types of windows, apply the current low-rise weighted average prescriptive requirement. So the current code, if you're familiar with it, has operative/fixed/glazed door differentiations in high-rise. The hope here is to simplify those measures moving forward and just go with all others.

Okay. The current code for high-rise versus low-rise has different methodologies for solar heat gain

coefficients and the effects of shading. So the proposal is to unify those methodologies and rather than having something different for high and low. That's one of the significant changes. And, again, this measure was packaged with the wall U-factor and all-electric HVAC submeasures to get to cost-effectiveness. Like I said, as of right now, I don't see that we're going in that direction, but we'd love to get any feedback.

Okay. So for curtain walls, lowering the U-factor requirement down to .38, the solar heat gain to .25, and all climate zones except for Climate Zone 1. 1 was found to be challenging to get to cost-effectiveness. And for all other windows, apply the low-rise res maximum U-factor of 0.30 and the solar heat gain coefficient at 0.23 in all climate zones, again except for 1. And in Climate Zone 1 so you get to the proposal of 0.35. Climate Zone 1 north coastal, a lot colder. They can benefit from solar gain more than from lower solar heat gain coefficient requirements. So you've got to pay with a bottom, but it demonstrates -- or that illustrates the proposal's U-factor, solar heat gain, and the visible transmittance requirements.

Okay. And here are the modifications that were made to the standard design and the prototype buildings to simulate the proposed changes. A lot of data on this, but since this is where they landed, and on the right you will

see the standard design and what they're measured against and in the proposed, and what's being proposed, right.

Okay. So in this scenario you will see that natural gas savings is the dominant energy savings on the far right of this table. Electricity savings is definitely not the energy savings that will lead this proposal, but again we'll get to the cost-effectiveness and see where everything landed in a subsequent slide.

Here is your curtain wall, ten-story building cost-effectiveness. Similarly, you're saving a lot on the TDV. And, again, you've got TDV energy savings, significant numbers on the far right side.

Now when you combine the All Others, all other types of windows, this is what you have. Again TDV energy. There is still pretty significant energy savings on the far right-hand side. We're getting to the main part here. The only challenge with some of these proposals is that there are multiple prototype buildings, and that means multiple tables, multiple data, multiple cost-effectiveness tables. So I apologize for all of the data that you're looking at.

Let me know if I'm going too fast. But, you know, I don't think that you want to spend the whole day looking at all of these, but I did want to include them to show the data.

Okay. Cost savings over 30 years. This is your

five-story prototype building that is having increased efficiency in the curtain wall, storefronts. You will see the 30-year cost savings are significant.

All right. Ten-story, the same thing, again gas costs this is the driver here, and similarly on the far right you will see the total. Everything is savings, saving money and saving energy. You get to the All Other Window category for five-story buildings, the same information, the same concept. You get to the ten-story All Other category, the same detail. Energy, money to be saved across the board. But I think this is where the attention on -- or all of those things get grouped into one kind of table that I think is very useful.

You know, for the five-story prototype building, for curtain wall and storefronts, you will see that the measures were not cost-effective in a significant number of climate zones. Climate Zones 4 through 10, 10 - 15, this measure was not cost-effective. And, again, I don't know that we're in a position to approve something that is not cost-effective on its own. And the proposal is to group those things, but I think we're leaning away from that.

Here is your curtain walls for ten-story prototypes. Similarly, a few that are cost-effective and then a significant number that certainly are not cost-effective, and where that's not true it will be a challenge

to implement.

You've got your All Other category for five-story prototypes. The same concept, a lot of numbers that are less than one, and when it gets less than one it is not cost-effective on its own.

Ten-stories, the same story, all but Climate Zone 1 are cost-effective by themselves.

Okay. Moving on to Alterations and Additions, again the goal was to uniform requirements where possible, across multifamily buildings based on fenestration type. And to that point I think it's important to note that while some of these measures may be appropriate for low-rise and not for high-rise or vice versa, we may need to move forward with that type of requirement, you know, while it may be simplest to group them all, you know, if they're not cost-effective, it may be most appropriate to have those requirements separated. And I have two different categories, right. Three-stories or less and then four-stories or higher where that may be appropriate.

So we'll get through these fenestration properties, additions, alterations proposals, and then we'll open it up to questions at Q&A. We're getting a few pop-ups on the questions there.

Okay. So again the proposal was to meet generally in the middle for the efficiencies and reduce the thresholds

set at less than 150 square feet per added or altered fenestration product and separate efficiency requirements for fixed/operable/glazed or curtain wall. This would result in increasing efficiency for buildings is four or more habitable stories and reducing stringency for buildings with three or fewer habitable stories. That 150-square-feet number is bigger than the current code. And, again, trying to unify these requirements does lead to some give-and-take, and we'd certainly love to hear your feedback. And an increase in stringency across all buildings was not found to be cost-effective.

So for alterations, you know it varied by climate zone, but this is essentially what it would like. And, again, you can see Climate Zone 1 is the primary outlier here. So there is the only one that's different, whereas Climate Zones 2 through 16, you know, all do show different values. And, again, a little bit different for Climate Zone 1, northwest California.

Energy savings, obviously it's going to be across the board when you increase minimum efficiencies, both on electric and natural gas on this proposal for alterations. And PV is significant, again cross the board.

So for high-rise existing buildings, similarly you're going to find the same energy savings across the board with these alteration requirements.

For low-rise res, this is where you're reducing stringency. And, again, this is something that we would love to hear feedback on. If we make this code more easily -- easier to comply with, it means we have to meet in the middle on some of these measures. And in this scenario, you know that means reducing stringency to try to land somewhere in the middle. But, like I said, landing somewhere in the middle in this scenario does reduce -- and increasing energy efficiency. And there's definitely some resistance to going in that direction, but simplicity is also part of the drive of this proposal, so we'd love to hear your feedback and hearing anybody's take on that.

You know here is your cost savings over 30 years. Again, if you're looking at the high-rise requirements, the energy savings is always obviously cost savings over a 30-year period. That's for alterations of curtain walls and storefronts. Moving to this, it's the combined operable or glazed door, again, money and energy to be saved across the board when you get to high-rise existing buildings and increasing efficiency. Cost-effectiveness, whether or not that money and energy savings pays for itself, you know, like we're finding especially in the fenestration properties when they live by themselves was more of a challenge. And we can see Climate Zone 1 was certainly cost-effective and 2 through 16 certainly were not cost-effective, again, by

themselves. And this is why the CASE Team proposed these as being part of an overall package of three measures to get to cost-effectiveness.

These are 10-story prototypes. The same story, the same scenario. I don't want to repeat that too much, but hopefully you've got the idea there.

So any feedback on the incremental costs or data as well as any feedback on the combination of measures, again, would be greatly appreciated and welcome.

Payam, I think I saw some chat questions maybe pop up.

MR. STRAIT: There are actually two questions in the Q&A.

MR. PEREZ: Yes.

MR. STRAIT: Do you want me to hope into those?

MR. PEREZ: Yes, please.

MR. BOZORGCHAMI: Peter, yes, but I think there's three. There is one that I think Joseph Holmes brought up and that was moved over to the answer column. You need to --

MR. STRAIT: Okay.

MR. BOZORGCHAMI: -- probably answer that question.

MR. CHRISTIE: This is Matt Christie, briefly. I apologize, I'm the one who accidentally moved that over and

then answered it anyway in text, but it may have come through in an awkward way, so.

MR. BOZORGCHAMI: Can you verbalize --

MR. CHRISTIE: I could summarize. Yes, I --

MR. BOZORGCHAMI: Yes, please.

MR. CHRISTIE: Yeah, I can verbalize, I can summarize verbally. Thank you.

So the question was asking if fixed and operable windows broken out or is everything required to have a 0.30 U-factor and then a comment that the 0.30 U-factor for the majority of class AW operable windows would be difficult with outward pane IDOs and uncertain about the cost-effectiveness of that.

My response was that, no, these are area-weighted averages across fixed operable and glazed doors. And we do anticipate that fixed windows will have an easier time coming in underneath the proposed prescriptive requirements to offset the difficulty of getting operable windows down to that level, that with the area-weighting average that is what makes it attainable without going to triple pane.

MR. PEREZ: Thanks for that, Matt.

MR. STRAIT: We also have a question then from Nick Young, who asks: Why not approve a package of measures that is cost-effective together, looking at cost-effectiveness of packages of measures rather than just one

at a time is a standard best practice in energy efficiency. You will always end up doing less and saving less if you take measures one at a time.

Do you want to speak to that or do you want me to do so?

MR. PEREZ: Have at it, Peter, please.

MR. STRAIT: So what we try to do with energy efficiency measures, it's not standard practice to take completely unrelated improvements to the building and say that one offsets the other. We want to make sure that the improvements we're requiring do justify themselves over time. That is, if a -- if a proposal is not saving enough energy to pay itself back, there is probably better low-hanging fruit to pursue.

So in this particular case, though, when we're looking at multifamily restructuring, what we're trying to do is really align what we're requiring of low-rise and high-rise, create some harmony there, create some -- get rid a lot of the rough edges that -- and kind of corner cases for both of them. In sanding some of those down and creating more uniformity across those requirements, there are areas where we might end up a little bit less than where we want to be. The CASE are kind of proposing some -- some broader tradeoffs than we are usually comfortable with.

That is not just saying, you know, these two or

three improvements that go together as a set make sense as a package, but that these different improvements occurring in different building systems might offset each other. So that -- for that reason we were interested in hearing from the public what their opinion is on having those little more complex tradeoffs than what we are normally accustomed to, because in general we want to make sure -- you know, in order to be good public servants and safeguard the public trust, we want to make sure we're not asking people to do things that wasn't out of pocket if there are better things that we can ask them to do.

Oops, I might have put the wrong one down. That is isn't a question, so I'm going to dismiss that. And you had some questions -- comments there that are not questions. We are still going to consider those, but we're going to, in the interests of time, not be reading them aloud here so that we can focus on people who have questions about what was presented or want more information from our presenters.

MR. BOZORGCHAMI: Yeah. One thing I just want to reiterate. The questions and answers are also being saved, and we will be going back to those also. So not that we're just dismissing them. We will be reviewing those too.

MR. STRAIT: Yes.

MR. PEREZ: All right. Is there -- were there any other questions?

MR. STRAIT: One just arrived. Joseph Holmes asks: Curious as to the thought process as why fixed U-factors are so much lower than curtain wall and storefront.

MR. PEREZ: Matt, do you want to answer that?

MR. CHRISTIE: Yes. So we -- the lower line that we have proposed for sort of the fixed operable, the blended IGU windows is based off of the current low-rise residential code as a basis for 3023. We're trying to accomplish that. Again, as Javier teed up in the beginning, we're trying to get alignment between two current chapters down to the more stringent of the two. And in the case of windows, low-rise was the more stringent by a fairly wide margin, and so that was one of the driving forces to try to push there. And that is sort of why that line was selected.

Additionally, the evidence is from that low-rise code currently under implementation that the availability of products at that thermal performance range and the cost of the products at that thermal performance range for, you know, punched windows, IGU windows is -- are both very available and common as it's currently the code for low-rise. And so extending that to similarly applied windows in high-rise made a lot of sense. Whereas the curtain wall product availability was a little bit more varied and didn't have that same precedent in low-rise of a -- to show the product availability in that thermal specification within

the low-rise sector in the current code, and so that's why there is a discrepancy in there.

MR. STRAIT: Appreciate that, Matt.

MR. PEREZ: Like I said, it's a challenging proposal to try to meld all of these measures and we certainly appreciate your guys' research and your findings. Even where they aren't cost-effective, it's important to know that, and certainly appreciate the ideas of ways to kind of combat that or -- or get to a position where we can unify them. But in the event that we cannot unify these measures, ultimately, you know, what we're talking about is we'll still have, you know, subchapters strictly for multifamily except there will be some measures that today for low-rise res multifamily or for three stories or less, three habitable stories or less, we will be at -- and in front of those that are greater, it will be wide.

You know we'd love to simplify this as much as we can, but we still have our constraints and our rules that we have to follow, and appropriately so. I think these are fair rules and that we were kind of set to follow and I think we'll be in a good place once we're done.

Okay, well, if there are no other questions we'll continue. Is that right, no other questions?

MR. STRAIT: I'm not seeing any more questions in the Q&A box and I'm not seeing any hands raised.

MR. PEREZ: All right, and I appreciate it.

Okay. So this is summarizing the methodology to get to cost-effectiveness for those three measures, right. Though, again, we talked about two so far, a wall U-factor and fenestration properties where those measures didn't account on their own. So the CASE Team's proposal included combining those with the all-electric HVAC option, which is part of another CASE report. But long story short, the savings on that end combined with these two prove to be cost-effective. And, again, I don't know that we'll be going in that direction at this time. But I do think it's important to present it and make sure that everyone sees, you know, what was proposed.

Okay. So for Climate Zone 16, as part of their grouped proposal, that would have or would require some level of PV system depending on the type of building that we're talking about. You can find the CASE report at the link on the bottom. And we'll be posting this presentation after this session where you can see it for yourself.

Okay. In short, you know the energy savings were significant. And, long story short, the benefit to cost savings was greater than one, easily for five-story prototypes and for the ten-story prototype building. And, again, Climate Zone 16 as part of the proposal would have required some level of PV to get to that target. But,

anyways, having said that, that's where they landed.

And there were variances for different types of framing. Again, we've got fire-rating requirements and varying systems, different -- whether it's mass walls or metal building or metal frames, you're going to find different tables here. And, again, the short story is then on the right-hand side. When you combine all three of these measures, they prove to be cost-effective.

I'm going to go through these fairly quickly, but I think you get the point is that alone they may not work, put them together, you've got something.

And I think we've already had a little bit of a discussion about the -- or at least opened this for discussion about the combination of these measures. So if there are any new comments than you had, I think, as Peter said, we'll keep it moving.

All right. So fenestration area. The fenestration area requirements that you're familiar with are low-rise residential requirements are limited by conditioned floor area. In other words, depending on the size of your home, you get 20 percent of that size as window area as an allowance. For a high-rise residential, this is different. It's all based off of your wall area. In other words, the more wall you have, 40 percent of that wall is what you're allowed to have as window area.

And these are prescriptive, these aren't mandatory, so theoretically you can build a glass house if you wanted to. You know, you're just going to have to make that building really efficient, right? That's not the say it can't be done, but you need to use UC high-rise multifamily with all glass.

Okay. And moving forward as part of this unification, the CASE Team landed on requiring both measures. In other words, 20-percent to window-to-conditioned-floor area. Applying that limit to high-rise buildings, as well as applying the 40 percent window-to-wall-area limitation for low-rise buildings.

So rather than going with one way or the other, they felt that it's appropriate to apply both of these, to ensure that we're not losing any -- any potential energy savings by going one way or another. Obviously when you go performance, and you do build that glass house, you will have performance kind of tendencies that you can make up in other aspects of the building.

The last thing that was proposed that removing the five-percent window-to-wall-area limit for west-facing glazing, which is currently low-rise requirements, this is -- can be really challenging if you're in a dwelling unit that's anything less or, you know, that five percent amount there when you've got a really good building that can be

significantly challenging. So, anyway, 20 and 40 is where we've landed in the proposal.

Okay. So the area limitations apply to all -- would apply to all newly-constructed multifamily buildings, to additions greater than 700 square feet in size, and alterations of more than 150 square feet of fenestration area. You will remember that 150 threshold from the previous alteration section for window efficiency requirements. So, again, trying to uniform these requirements and make sure that there is not two different targets floating, depending on the type of alteration that we're talking about.

The CASE Team didn't find any technical feasibility challenges. There was no energy simulation performed. No energy cost savings because this is really kind of meeting design criteria. And we're not increasing stringency when we're doing this. So as part of no stringency increase, no costs, no cost-effectiveness analysis is necessary. But I do think this is something that we would love to hear industry's feedback on. I think there are some scenarios where maybe meeting the 20 percent or meeting the 40 percent window-to-wall-area ratio might be challenging. In speaking to consultants, there are some areas, where maybe your common areas you might be a little bit more restrictive or less restrictive depending on the

scenario. That one's a very brief proposal, needless to say, we're applying both measures 20-percent conditioned-floor area for window-area limitations and 40-percent window-to-wall-area limitations for the entire building.

If you have any questions or comments, please feel free to speak up right now.

MR. STRAIT: So Karen Kristiansson does have a question in the question-and-answer box. She's asking whether HVAC is very effective in carrying the others in terms of measures or if they work together differently.

MR. PEREZ: Matt, do you -- or maybe Alea may be able to speak to that one?

Or let --

MR. CHRISTIE: I could speak to that one. Yeah. Sorry. I was -- this is Matt Christie again. I can speak to this one.

So from the all-electric proposal that includes the use of electric heat pumps for space heating and heat pumps for water heating, the cost savings are significant, and that helps carry the cost -- the high costs of the windows and the walls that were proposed. And so, in summation, the overall savings -- cost and savings of the VC ratio comes in over one when combined that way.

MR. PEREZ: Thank you.

All right, if no other questions we'll move on to

the Mechanical Unification Measures in the Proposal.

Okay. So starting with duct insulation. And this is another one of those scenarios where it wasn't cost-effective to apply the more stringent requirements across all buildings. So, you know, there was a meet-in-the-middle requirements where R-4.2 would be the mandatory duct installation requirements on supply ducts inside of indirectly conditioned space in all multifamily buildings. That meant for the most part that's where these ducts lie.

So no change to uninsulated ducts inside of directly-conditioned space. And when you think of directly-conditioned space, you're in the room that you're sitting, right. And if it's exposed to the space that's being directly conditioned, then there is no change to those requirements.

And then apply the low-rise mandatory R-6 insulation requirement to ducts in all other spaces. And, again, from high-rise multifamily, most of the ducts are going to fall in that first category, being that they're somewhere inside the building or inside the thermal boundaries, right.

So prescriptively, the change would be to apply low-rise R-8 to all ducts in all other locations in specific climate zones, excluding 5, 6, and 3, and 7 -- sorry -- so 3, 5, 6, and 7, but everyone else would increase that

requirement.

So, in general, this results in less restrictive requirements overall. And, again, we didn't find that it was cost-effective to go more stringent across all buildings, so less stringent R-4.2 does make a difference. And that will be pro ordered. What does that look like? And, again, the scenario where we're trying to make the quote simpler and not have variances in low-rise versus high-rise. And that as a result of doing so, you're going to see across these tables that you're losing energy, you're losing energy efficiency and increasing energy consumption, right, in building.

Now because this measure introduced a reduction in stringency of efficiency measures, there was no cost-effective analysis done, and it doesn't really apply because we're not being any more restrictive. And, again, this is something that we'd really like feedback on. You know decreasing efficiency is not something that you often see, but again reorganizing the Energy Code is also something that you don't often see. And these two things can't really coexist without one of them giving, right? So this proposal shows energy giving and not simplicity giving. So, again, any ideas, any thoughts, whether it's on the docket or no, we'll be happy to receive them.

I'm hearing radio silence. I'm assuming there's

nothing in the chat there.

MR. BOZORGCHAMI: I have not seen anything, no.

MR. PEREZ: Excellent. Okay, well, thank you, Payam.

So we'll continue on. Okay. Leakage testing is something that is intending to be, again, uniform across all buildings. But currently, the current code doesn't require duct leakage testing for multifamily buildings if less than 25 percent of the ducts are in unconditioned spaces. You know we'll get to that at the bottom of the slide.

But the goal here was to apply mandatory verification and duct ceilings for multifamily buildings. We have three stories or less up to all high-rise or four habitable stories or greater multifamily buildings. And only when it's an individual system. In other words, if you've got essential systems serving multiple dwellings, then that's not within the scope.

With regard to best location, 12-percent leakage or six percent to the outside, and that 12 percent is similar to what you're already seeing for multifamily buildings, so no change there.

Alterations or additions, the same concept: 15 percent or 10 for the outside. And, again, that's the same, with no change.

And then the scenario in alterations where you

couldn't achieve that target, when a smoke test would be the expectation in sealing up any accessible leaks.

So 2019, currently, only requires duct leakage testing for high-rise res buildings prescriptively, not mandatory. For single zone constant-volume systems serving less than 5,000 square feet, where more than 25 point of the duct search there is in unconditioned space.

And, again, that's not very common. That's not very common in multifamily buildings. Usually there would have been cavities inside the dwelling or, yeah, within the thermal boundaries. Under the current code, for multifamily high-rise, the max leakage is six percent. For 12 percent, for low-rise multifamily, and again trying to apply that as well going forward.

Okay. Here are some assumptions as far as leakage and per ton air capacity for the five- and ten-story prototypes where we're now proposing duct leakage testing. And we didn't find that this is a challenging measure to get cost-effective. Here are your energy reductions. And the reality is that these savings are conservative, you know, I think appropriately so. When these reports are done, they should be, but they may not capture all energy savings, and that's important to note here.

Here's your ten-story prototype building. And new construction, five-story, the cost savings over 30 years

which is significantly low, and again it's a little bit challenging to capture all of the possible savings and this is a conservative estimate. Similarly, ten-stories. Again these numbers are fairly low.

And here's your first cost summary, HERS rater, and this is again per dwelling. I'll let Matt correct me if I'm wrong, but I'm pretty sure this was per dwelling. So material, labor, HERS rater, and total incremental first cost. And with their data, again if you find these numbers are too high or too low, again please feel free to chime in.

The duct leakage testing summary for alterations or replacement cost. Again this is what they estimated for those values.

And this is where we get into the same challenge that you've seen with a few of the different measures. In trying to unify the code requirements and apply them across the board, it can be challenging to prove cost-effectiveness.

In this scenario with the HERS measures, the CASE Team proposed that the three HERS measures, we'll get to them in a second, be grouped together to demonstrate cost-effectiveness, because again duct leakage testing was a real challenge to prove cost-effective in these scenarios where the ducts are inside of the building. That was a challenge, and I think that will continue to be a challenge.

So, anyways, again standalone duct leakage testing, we're looking at the five-story prototype did not prove to cost-effective and the same can be said for the ten-story prototypes.

So that's duct leakage testing. Any feedback on those measures would be appreciated. And, again, any comments can be submitted to the docket after -- after the session. That's not a problem.

It doesn't look like there is anything, Payam?

MR. BOZORGCHAMI: No, not at all.

MR. PEREZ: Okay, all right. Continuing on.

So fan efficacy and air flow are two measures that are mandatory for low-rise res buildings. The current requirement is a minimum of 350 cfm per ton of cooling and then .45 watts per cfm for central gas furnace fans, and then .58 for all others. And that differentiation in .45 and .58 comes from federal requirements for the motors for those central gas furnaces.

So the hope or the intent here is to apply that to high-rise multifamily buildings where applicable and cost-effective. Again applying the alterations and additions when you completely replace other space system. And then there's are the same, currently low-rise res does this already, but completely replace the system, the expectation is that you meet all of air flow and fan duct efficiency

requirements.

Okay. There was some component of this from the mechanical cooling that was not part of the draft report, be the CASE Team seemed to say that they would plan on including in the final report, but I think we can move forward with what we have for today's purposes.

Okay. So here are your prototype buildings, the five- and ten-stories. Standard design parameters are 300 cfm per ton not proposed meeting that 350, and the watts per cfm, the exception for your standard design is .8. And meeting efficiency, assuming it's a gas central fan furnace, .45 watts per cfm would be expectation, or the proposed parameter.

Okay. You will see first year impacts for five-story prototypes for air flow and fan efficacy here. TDV savings are pretty significant relative to what you saw in the duct leakage testing. Again, natural gas savings is a little bit less, but overall TDV energy savings is great.

Similarly, ten-story, when you're increasing air flow and fan efficacy you're going to find significant savings.

All right. So newly-constructed air flow and fan efficacy, you will see again the cost savings. Again, if you're losing energy on the gas side, you will lose costs on the gas side, but overall, you know, you're still saving a

significant amount. And this is assuming buildings use natural gas for their heating. If they use electricity, then obviously these in the red would not play a role.

Your ten-story prototype, similarly a reasonable amount of savings.

Some assumptions for air flow and fan efficacy verification. It's really just involving a third-party inspector to come out and test that system to make sure your air flow and fan efficacy achieve appropriate targets, so the incremental cost is really tied to that HERS rater.

And for alterations, a little bit different, but here is the table for the alterations and the replacement costs per dwelling unit.

Okay. Benefit-to-cost ratio, this one was cost-effective on its own, and we're looking at the five-story prototype building for new construction right now. So incremental costs and energy savings calc out to have significantly high benefit-to-cost ratios in everywhere but Climate Zone 1, but having said that Climate Zone 1 still proves to be cost-effective on its own. Whereas again in leakage testing, you saw was significantly more challenging to get to that 1.0 number.

Ten-story buildings, you see a little bit more conservative numbers, but the same concept, definitely shows to be cost-effective in every climate. And you can see why

grouping this with leakage testing would bring them both across the finish line pretty easily there. Again I don't know that we're going in that direction.

I think air flow and fan efficacy, that one was a quick one. Any questions, any comments?

MR. BOZORGCHAMI: Javier, no.

MR. PEREZ: All right. Okay, believe it or not, we're more than halfway through here, so I appreciate you guys staying on.

So moving towards refrigeration charge verification. The other HERS verification measure for HVAC systems, the goal here was to apply the prescriptive HERS verification requirement for refrigerant charge for low-rise buildings up to high-rise buildings, up to buildings with more than habitable stories. The current code does not have refrigerant charge verification requirements for any multifamily buildings that are over three habitable stories, so this would be a change. But, again, it is a prescriptive change, not a mandatory change.

And obviously it applies to cooling systems. So if you don't have a cooling system, there's no refrigerant to check. Applies in Climate Zones 2 and 8 through 15. This is the same as applicable to low-rise residential. And, similarly, as for low-rise res, applied to alterations as well when refrigerant-containing components are altered.

If you have to recharge that system, it's beneficial to make sure that we get that refrigerant charge verified by a third party inspector.

Okay. Here are the modifications for the standard design and proposed design and how they determine energy savings and cost savings as part of the prototype buildings.

The first-year impacts for five-story mixed-use buildings, you will see ten-story on the next slide, but because this is a cooling measure, you can see zeroes across the board for gas, and obviously electricity savings or losses, but there are going to be savings that contribute to the TDV energy savings.

This is your ten-story prototype energy impacts. The same concept: No gas. This is a cooling measure only.

Okay, energy cost savings. Again across the board nothing for gas and Climate Zones 1 through 16 did show cost savings across the board. And that was the five. This is the ten. Again I don't want to bore you with these, but they're included here for completeness.

Here is your benefit-to-cost ratio. And if you're for all climate zones, now keep in mind that it's proposed for Climate Zone -- I need to double check on that -- 2 and 9 through 16 -- 9 through -- 2 and 8 through 15, will do it further in charge, climate zones that it would have been applicable to. Yeah, so in the climate zones where it is

proposed, it was proven to be cost-effective.

Here's your ten-story prototype and the same concept, the same answer. 2 and 8 through 15 were cost-effective across the board.

Any questions on the refrigerant charge verification measures? That one was pretty straightforward.

MR. BOZORGCHAMI: So far I see none.

MR. PEREZ: Okay. This is the combination of HERS verification measures, and I'm realizing that this slide needs to be updated. I will have it updated before we post it. But, in short, this is like the envelope measures that we talked about. Verification of air flow, fan, and refrigerant charge were grouped to demonstrate compliance together. You know they did not prove cost-effective alone with refrigerant charge. You saw that air flow did the leakage testing, which is a significant challenge. So for that reason again the proposal was to group them and, in short, it didn't seem they were going in that direction, but for completeness we're going to show you what that looks like.

Here is the -- as a group, the benefit-to-cost ratio for five-story prototype buildings, when you -- I'm sorry. When you group these measures together. And the ten-story prototype, -- sorry, I went through that a little too fast there. But, essentially, what they found was

grouping them together did find some cost-effectiveness, but again it's not something that we'll be going forward with at this time. But we'd love to hear your feedback, you know if you have any ideas about regrouping of the measures and requiring grouping of HERS verification measures, now is the time. Otherwise, on the docket would be appreciated.

No questions, no comments.

MR. BOZORGCHAMI: Not seeing any at this time.

MR. PEREZ: Okay. All right.

MR. BOZORGCHAMI: We have one raised hand. Hold on one second. From Shawn.

Shawn, I'm going to unmute you, and please state your name and affiliation, but before doing so you need to unmute yourself also.

MR. MARTIN: Okay, can you hear me?

MR. BOZORGCHAMI: Yes.

MR. PEREZ: Yes.

MR. MARTIN: Okay, great. Thank you. Shawn Martin with the International Code Council. One question I have is, and forgive me if I missed this anywhere, in looking at the different CASE reports, they talk about the greenhouse gas impact of various systems utilizing refrigerants, whether it be, you know, air to water or air to air, whatever. And I have yet to see any mention of the global warming potential associated with the refrigerants

used in these devices. If I'm not mistaken, some of them have GWP values that are in the thousands, to 2,000, 3,000, 4,000, depending on the specific one. Obviously a large-scale deployment of refrigerant-based system will lead to some leaks. Has there been any efforts to quantify the gains regarding carbon reduction from reduced energy use against the losses associated with high GWP refrigerant releases? And, like I say, if I missed it any of the CASE reports, please feel free to refer me there.

MR. PEREZ: Yeah. Ideal I to see if Peter has any experience with this topic.

MR. SHIRAKH: Hi. This is Mazi. I can probably respond to that.

MR. PEREZ: Excellent. Thank you, Mazi.

MR. SHIRAKH: So, yes, thank you for that question. We are actually working very closely with ARB to address these issues, at the Air Resources Board. It's a separate effort outside of this Multifamily, and that's basically for all buildings.

We are considering the impact of CO^2 emissions as well as methane leakage within buildings as well as the GWP of refrigerants. So this is an ongoing process and we have made some progress related to the methane leakage and the CO^2 reduction from both energy efficiency and different technologies.

When it comes to the refrigerant GWP, we have not incorporated those into the TDVs yet, and -- but that is a work in progress. Here we may or may not be able to incorporate them in the 2022 TDVs. The timing doesn't look good. So we may have to wait for that until the 2025 TDVs. Thank you.

MR. MARTIN: Thank you very much, Mazi. I appreciate that response. Yeah, I'm so pleased to hear that there is an effort there.

One note, if I could, at ICC, obviously you know we build the building codes and one of the challenges has been as the industry has worked to lower the GWP, they have looked at various alternative refrigerants, but in doing so they have increased -- generally speaking, they have increased things like toxicity and flammability a little bit, and so I guess I would just encourage your folks if they are looking at alternatives to address this, that, you know, the whole picture with those other efforts --

MR. SHIRAKH: Yeah. Those are --

MR. MARTIN: Yeah.

MR. SHIRAKH: -- are -- those are exactly the issues, flammability and toxicity. And that's what is basically holding us back at this point from incorporating them. But I mean, again, this is very active, and the industry knows, the regulators know, and we will see where

it goes.

MR. MARTIN: Yeah. Thank you.

MR. SHIRAKH: We're definitely -- thank you.

MR. BOZORGCHAMI: Shawn, with respect to -- this is Payam -- with respect to the inflammability, at the Energy Commission, with the help of the ARB and the State Fire Marshal, we have been working on that and trying to look at different versions and understanding that there are higher ability issues with them. So that work is in progress, and the State Fire Marshal has taken a lead on that to see how we can implement that into the Building Code. Not per se in the Energy Code but in the Fire Code.

MR. MARTIN: Thank you.

MR. PEREZ: I appreciate your question, Shawn.

Thanks for the support, Mazi. And thanks, Payam.

Are there any other questions or comments?

MR. BOZORGCHAMI: Yeah. Meg Waltner had -- has a question for -- to clarify. Are you moving -- are you not moving forward with HERS verification measures at all or not grouping them with other measures.

MR. PEREZ: Go ahead, Payam.

MR. BOZORGCHAMI: This is the whole HERS verification issue and how we're going to deal with that for this current code cycle.

MR. PEREZ: Yeah. We're definitely open to

feedback, but as far as grouping is concerned, at this time I don't know that we are going to be doing that. So what does that mean for the measures as they stand, if they prove to be cost-effective independently, then they will be considered for introduction into the 2022 code, but in scenarios where they are not cost-effective, then they would not be -- they wouldn't make the cut.

Does that answer your question?

MR. BOZORGCHAMI: "Yes, it does. Thank you."

MR. PEREZ: Wonderful. Okay, okay.

MR. BOZORGCHAMI: That was Meg saying that, not me. But, yeah, thanks.

MR. PEREZ: I hope so. All right, well, thanks for your participation, Meg, and to Shawn.

I think that's it for me.

MR. BOZORGCHAMI: Javier, there you go.

Again, you will see -- like I said earlier on, -- this is Payam -- you will see this over and over again. And the presentation that Javier did today will be posted on our docket up by -- I want to say -- tomorrow morning some time.

So with that, thank you, Javier. And I think your next slide has contact information for yourself, me, and Larry, yeah, as the project manager for the CBECC Compliance Offer program.

MR. PEREZ: My last name is Perez. So if you see

the email address, we'll fix that typo before it's posted. I'm also an Energy Commission Specialist. I'm not a mechanical engineer with the Energy Commission.

MR. BOZORGCHAMI: I apologize. I will fix that. Sorry about that, Javier.

MR. PEREZ: Not a problem. No worries. Okay. Thank you.

All right, well, that's it for me. I will hand it over back to you, Payam.

MR. BOZORGCHAMI: Thank you.

And actually next is Danny Tam. He will be talking about the multifamily water heating systems.

Danny.

MR. TAM: Yup. Sharing my screen. Can you see it?

MR. BOZORGCHAMI: Sure.

MR. TAM: Hi. I'm Danny Tam from the California Energy Commission. I'm a mechanical engineer in the Title 24 Building Standards Office. And this is going to be on water heating. I will be presenting the proposed 2022 changes for multifamily water heating distribution systems and high-efficiency boiler surface water heater.

We will start with the Multifamily Distribution Proposal. Here is the summary of the proposals. The proposed changes will apply to central water heating systems

in newly-constructed multifamily buildings for both low-rise and high-rise. There are three measures. The first one is to increase the mandatory pipe insulation thickness for pipe diameters not larger than two inches. We want to add a new compliance option for buildings that meet the California Plumbing Code Appendix M pipe-sizing procedure. And, finally, we want to modify the existing two-loop requirement and will fit to compliance option.

Here are the sections affected. Most of the changes go into the new multifamily section. And in Section 120.3, this is where it contains the pipe insulation requirements.

So the pipe insulation measure will increase the mandatory pipe insulation requirement for multifamily DHW distribution systems. For pipe diameter larger than one and a half to two-inch thick. We also want to create a new subsection in Table 120.3 specific to multifamily DHW systems. This will effectively align the multifamily pipe insulation requirement with the Plumbing Code, which they have their own insulation requirement.

And Appendix M submeasure will add a new compliance option under the performance compliance method. Appendix m contains the optional alternate pipe-sizing procedure that typically results in smaller pipe size and reduce water volume in the distribution pipes, which, in

turn, this will result in lower distribution heat loss and less wait time for hot water.

The third submeasure will move the two recirculation loop requirement from a prescriptive requirement to a compliance option. We receive feedback over the past couple cycles that there was there was some confusion about what actually qualifies for the two loops. And there is also some uncertainty on whether the two-loop -- whether all two-loop design will actually save energy. So we also don't want to remove it completely, so we want to move it as a compliance option, so leave room for future CSE improvements.

Here are some statewide energy and energy costs impact for increased mandatory pipe insulation. Statewide, it's in the million therms, savings of .29 million therms. Here is the 30-year present value savings that we anticipate to see. And then for Appendix M, this is per dwelling statewide for low-rise garden, about one therm per dwelling units; and low-rise corridor, 1.6. And you can see as the buildings get larger, the savings get larger. So mid-rise mixed use, about 2.6 statewide per dwelling units. And for high-rise mixed use, 3.1 therms per dwelling units.

So first year, statewide GHG impacts, about .12 million therm per year and 673 million -- sorry -- metric ton CO^2 equivalent savings.

So in terms of technical feasibility, there were some concerns early on about product availability for two-inch pipe insulations. The CASE Team found that the product is available from multiple manufacturers. Also there was concern that if everything would fit with the current pipe insulation, the CASE Team found that most instances of large pipe plus insulation assemblies happens on horizontal pipes or at the water heater plan itself, so they believe a space limitation is less of an issue.

So in terms of cost-effectiveness, pipe insulation is cost-effective for all climate zones. And Appendix M is a compliance option, but we found that not only that it reduced energy consumption, it's actually a cost-savings measure, so it's hugely cost-effective.

Here is where you submit your comments and here is my contact, Danny Tam. You see Payam and Larry.

So, Payam, any questions on this measure?

MR. BOZORGCHAMI: We have one raised hand.

Jim, I'm going to unmute you. Please state your name and affiliation. Thank you.

MR. LUTZ: Jim Lutz. I'm a consultant.

MR. BOZORGCHAMI: I apologize, Jim. You need to speak up a little bit. We can't -- I'm having a hard time hearing you.

MR. LUTZ: I moving off. I can hear. I'll just

ask my question. I tried my question through Q&A.

MR. BOZORGCHAMI: Okay.

(Pause in the proceedings.)

MR. TAM: Payam, move on, or what would you --

MR. BOZORGCHAMI: Let's wait a minute or two for Jim. He's going to type his question.

MR. TAM: Okay.

MR. BOZORGCHAMI: That way I know which question goes with which measure, yes. I apologize.

MR. TAM: Okay.

MR. BOZORGCHAMI: So, Danny, Jim's question is: Would you discuss the two-loop recirc option more, a little bit more? Can you go into a little bit more detail in the recirc option?

MR. TAM: So currently we added a two-loop requirement back in the 2013 standard. So it applies to all central hot water systems. It states that the system needs to have two separate recirculation loops. So over the years we -- we heard that not all two loops guarantee energy savings. That's what we found when we implemented the current software. Also there was some confusion from designers. You know, what exactly qualified for the two-loop, because I guess for high-rise there's multiple, multiple loops already. So for this -- mostly this is for the MG impact, personally. So we decided to move it as a

compliance option, and, you know, if people still want to use two loops, they can use performance.

MR. BOZORGCHAMI: Thank you, Danny.

There are no more questions or raised hands. Go ahead and start your other presentation. Thank you.

MR. TAM: Okay. Now we're moving on to the high-efficiency boiler and service water heating proposals. Here's the summary. We received proposals that increased the prescriptive requirement for minimal thermal efficiency to 90 percent for gas water boilers for space heating and surface water heater. This will align the current requirement and ASHRAE 90.1.

Also as part of the proposal we want to add some requirements to the distribution systems to optimize condensing operation and efficiency.

Finally, this proposal lowers the capacity threshold for the mandatory oxygen concentration requirement for process boilers.

Here are the sections affected. It's mostly nonres.

So the first submeasure will raise the minimum thermal efficiency for gas-fired hot water boiler systems for space heating to a weighted-thermal efficiency of 90 percent. This means if there are multiple boilers in the system, it's the weighted average, not every single boiler

needs to be 90 percent. This applies to boilers with capacities between one and ten million Btu per hour installed in newly-constructed nonresidential and high-rise residential buildings.

Like I mentioned, there are some additional requirements for the distribution systems. This is to ensure the boiler operates in the condensing range. If the incoming hot water, if the incoming water comes in too hot, then the flue jets will not condensate and will not reach the 90-percent efficiency. So these requirements ensures that they operate in the condensing range.

So the requirement would require that the return temperature of the hot water to the boiler to be 120 degrees or less, or the flow rate for the supply of hot water that circulates directly back to the return system needs to be controlled so that the flow rate is less than 20 percent of the design flow as an operating boiler.

There are some exceptions. So if 25 percent of the space heating requirements are met by onsite solar, the site recover energy or heat recovery chiller are exempt. Also there is an exception if at least 50 percent of the design hearing load is from perimeter convective heating, radiant ceiling panels, or both.

The second submeasure is very similar. It's for gas surface water heating. It will raise the thermal

efficiency to rate at a thermal efficiency of 90 percent. This will apply to system capacity 1 million Btu per hour or greater in newly-constructed nonres and high-rise residential buildings. Also have an exception if 25 percent of the water-hearing requirement is met by onsite solar or site recovered energy.

Third submeasure. We have existing mandatory requirements for process boilers for oxygen concentration. This measure will simplify the language. And now all process boilers with an input capacity of five million Btu per hour or greater needs to maintain stack gas oxygen concentration less than or equal to three percent. There is an exception from this requirement: If the efficiency is above 90 percent.

Some statewide energy costs impacts. This one is for gas boiler for space heating. Statewide, about .37 million therms. And for gas service hot water heating system, it's about .02 million therms for the state. And for oxygen concentration, .62 million therms statewide. So statewide GHG impact is all from natural gas savings, so about one million therms per year. And reduce GHG 5,551 metric tons of CO^2 equivalent.

So in the CASE report there are like dozens of tables of different building types for a benefit-to-cost ratio. I didn't want list them all, so I just want to do a

summary. So you can see for gas service water hearing, it's wildly cost-effective for all building types and climate zones. The same thing for the oxygen trim control for process boilers. For space hearing, there are some building types that are wildly cost-effective and some that are not, as you can see here, .07 to 6.59 benefit-to-cost ratio.

In terms of technical feasibility, condensed boilers are pretty much a mature technology and oxygen trim control is already an existing Title 24 requirement.

In terms of cost-effectiveness, cost-effective for all climate zones and building types for gas surface water hearing, also for oxygen trim control. It is cost-effective for certain building types for gas or for space heating, and not cost-effective in others. So in the final language, we'll most likely only list the ones that are cost-effective.

The same thing again, here is where you submit your comments. And my contacts. And I bring it back to Payam.

MR. BOZORGCHAMI: So, Danny, we have two questions in the Question and Answer. I'm going to -- one I think, it's just a continuation of your previous presentation on the multiple loops, so we'll go back to that one after the question on this topic after. But Shawn Martin from International Code Council asks a question: For the

exceptions where onsite solar contributes to at least 25 percent of the energy, can you clarify what that means? That percentage can be based on total gas offset as a result of onsite solar or it can be based on energy contain of the delivered energy. One accounts for the gas boiler efficiency and the other does not; which are you intending to use?

MR. TAM: If George on the CASE Team can answer, but typically we use TDV, so it needs to be equivalent to TDV energy, so 25 percent of the TDV energy of space heating or water heating mode.

In terms of how we meet it, those are the kind of details I feel is up to the compliance manual and the forms. You know, we'll figure on a method to determine what -- how to come up with the 25 percent.

MR. CHAPMAN: Thanks, Dan. This is George from the CASE Team. So to clarify, the exception here at the 25 percent is this closely matching the actually 90.1 language, basically our exemption to preemption is along with the line that was actually 90.1. We have sought to do with the language here, including the heat exceptions, so that's the basis of it.

In terms of how it's figured, it would be consistent with obviously Title 24 and TDV, as mentioned,

and that would be clarified through the compliance process, also as Dan highlighted. And, again, just in terms of context, the objective here is that in the ASHRAE 90.1 alignment.

MR. BOZORGCHAMI: Okay. Any other questions? If not, Danny, can you go back two slides? And before we do that, -- one slide. Sorry. Not this one. The one with the docket information. There you go -- we have another one that came from Steve McCool: Is the Commission expected to change the minimum gas-fired efficiency for the replacement market statewide, currently 80 percent as federally mandated, the CEC offers the highest rebate on 90 percent -- 94 percent plus efficiency equivalent?

MR. CHAPMAN: Danny, I mean -- and this is George again.

MR. TAM: Yeah.

MR. CHAPMAN: I obviously can't comment on anything the Commission is going to do.

MR. TAM: I don't --

MR. CHAPMAN: For the utility-run programs, I expect this is -- that might be related to -- the rebates are presumably related to the IOU programs. You know, this is applying to only new construction. So the replacement market is not impacted by these requirements. I would expect the IOU programs would continue to offer incentives

based on the realities of the replacement market and all of the various considerations that go with that.

MR. TAM: Yeah, I was muted. I was going to say, yeah, these measures are for newly-constructed buildings only and does not affect the replacement market.

MR. BOZORGCHAMI: Okay. So if there are no more questions, I'm going to backtrack to your previous presentation. And Jim Lutz has a quick question regarding the loops as asking: Are the multiple loops going to be improved in the software?

MR. TAM: That's a question for you, Jim.

We have to work with Bruce and the team. It's a matter of priority. You know, they're super busy, but we do need to make some improvements in the loop design.

MR. BOZORGCHAMI: So we could -- on that one, we could backtrack and work with Bruce and come up with why -- the methodology probably, so, yes, we could look into that.

MR. STRAIT: Do you want me to read the next question?

MR. BOZORGCHAMI: I think we did that already.

MR. STRAIT: Oh, the onsite solar?

MR. BOZORGCHAMI: Yeah. I just didn't have a chance to --

MR. STRAIT: Okay.

MR. BOZORGCHAMI: If there are no more questions

or comments, or if you guys, folks on the phone decide that you have more comments or concerns, we will have this presentation and the previous presentations all docketed into one file tomorrow. And if you come up with any ideas or concerns, you have our contact information and you have the docket information. So with that, this concludes today's workshop. Thank you.

(Whereupon, the workshop was concluded at 11:07 o'clock a.m.)