BEFORE THE
CALIFORNIA ENERGY COMMISSION

Staff Workshop on Draft 2013 Building Energy Efficiency Standards Revisions for Residential and Nonresidential Buildings

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P R O C E E D I N G S

JUNE 9, 2011 10:06 A.M.

MR. SHIRAKH: Good morning. I think we're going to get started. I'm Mazi Shirakh, to my left is Martha Brooke. And we are the Project Managers for the 2013 cycle of the standards.

I just wanted to apologize, you know, for being late a little bit. I know that the meeting notice said the time was nine o'clock but since then what happened was two or three topics were dropped from the agenda today so we moved it to ten o'clock, which actually, I think, works better for most folks who are traveling from the Bay Area here.

So we have a number of topics on the agenda. The first one is going to be nonresidential fenestration update and Eric Shadd is going to present that. He is with the AEC. Then after that is going to be upgradable setback thermostats. Josh Rasin and myself will be presenting that topic. And then we will break for lunch. After lunch we have three topics. One is multi-family domestic hot water heating and Yanda from HMG will be presenting that and he will also present the residential high efficiency water heating ready measures. The last topic of the day is going to be residential domestic hot water systems and Mark Hoeschele from the Davis Energy Group will be presenting that. So that's basically the agenda.

At the entrance to the room there is a sign-in sheet so we would appreciate if you wrote down your name and your contact information. The best thing would be to staple your business card and that way we have a list of all of the attendees here. We also have a court reporter here. So for that reason anybody who wants to speak – I know it is sometimes tempting to yell from the audience – but, you know, you really need to come to the podium here and you need to introduce yourself and your affiliation. And if you can hand a business card to the court reporter. It really makes his life easier.

So with that, I have a brief presentation. For those of you who have seen my presentation before you can hit the snooze button. But since the audience is sufficiently different here I think I need to go through it. There have been a few changes related to the schedule and I would like to discuss that.

And for those of you who are going to be here, tomorrow’s workshop also starts at ten o’clock instead of nine, as was previously noticed. Next slide, please.

So these are the various policy goals that are driving the effort for the 2008 standards. Basically the goal here is to move towards zero net energy. And we are also coordinating with the Green Building Standards that were published in 2008. And we will talk about the REACH

Standards a little bit later, which is part of this effort, too. Our major collaborators are the California investor-owned utilities. That includes PG&E, SCE, SDG&E and Southern California Gas. And they have been really forthcoming with their resources, both in terms of funding and contract resources. Most of the measures that are under consideration for this round of standards have been sponsored by the IOUs. PIER, the Energy Commission’s research program, is a critical part of it and we also get a lot of input from various stakeholders.

These are the famous Rosenfeld graphs, which we think documents the impact of the building and appliance standards in the State of California. The green graph here is California’s per capital kWh consumption and the red is the entire US as a whole. And what you notice is that before 1976, you know, the two graphs generally had the same slope. What happened in 1976 was the introduction of the first appliance standards followed by the first building standards. And ever since then we have pretty much kept the per capita consumption fairly constant.

This one shows that the State of California is the most energy efficient state in the union when it comes to per capita energy consumption with a little less than 7000 kWh per year per person, while the entire US is roughly around 13,000.

Our effort is to move toward zero net energy and, you know, we are going to have two more rounds of standards besides 2013 and the goal is for the residential to reach zero net by 2020 and we are hoping we can save around 20 to 25 percent for residential for each cycle and 15 percent for nonres. And the goal for nonres is zero net energy in 2030. And again we are incorporating the REACH Standards for the first time, which is going to go into the Part 11 of the Title 24. And we are aligning our timelines with the California Building Standards Commission, their triennial cycle, for the fist time, which is going to be an interesting challenge for us. But the nice thing would be that the entire code would be published at the same time, all 11 parts of Title 24 and that we will be in sync with them.

Some of the things we are trying to address as part of Title 24 is simplicity of the standards or simplification of the standards. And we have all heard a lot of anecdotal and real stories about complication of the standards. And the message we have been giving to the team consistently throughout this cycle is, you know, keep things simple even if it means sacrificing a few kilowatt hours here and there. We think in general having simpler standards that are more understandable and enforceable are superior to complicated standards that nobody understands or can follow. So we are going to follow that message all the way through.

And to do that, you know, some of the things we are doing besides writing simple codes is changing some of the measures from prescriptive measures into mandatory requirements so everybody knows it has to be done. There are no trade-offs, no questions. We are going to review the number of exceptions we have in the standards. The exceptions are there for a purpose but they do tend to complicate the standards and if they outlive their usefulness we will get rid of them. We are going to try to simplify the forms and actually create a form generator, an electronic form generator that works in many ways like some of the tax software that you have. You know, when you are using that you don't really need to know about the forms when you are using, like, TurboTax all you need to do is answer a few questions and the software will figure out what forms need to be spit out.

We are also thinking about simplifying the interface of our compliance softwares for both res and nonres to make it easier to actually identify the type of trade-offs one wants to do and neutralize the fields that are not under consideration. We are also considering creating an Energy Commission-based central repository. This is kind of an extension of the effort that started in 2008 creating the HERS registries. You know, people have to upload certain types of compliance documentation and with this repository those documents will actually get transferred into a CEC repository.

You know, we are considering other types of not directly energy-related measures into this round of standards, like greenhouse gas emissions and effect of reflectance on the roofs. We are considering for the first time water-saving measures not directly related to power, roof deck insulation in residential buildings, proper orientation of buildings, and considering some type of trade-offs between PVs and certain types of building features.

This is the schedule for the 2013 standards. We are kind of in the middle here, this timeframe where we are holding staff workshops. By September we are supposed to have our first draft of the standards marked up with track changes. And then in the Fall we will start the formal rulemaking process where we present 45-day and, if needed, the 15-day language. The most important dates here are in red, the March 2012 adoption date of the standards if everything goes as planned. In July of 2013 is the publication date of the entire code, which will be published by the Building Standards Commission and hence the name 2013 Standards. The effective date is January of 2014.

As with all the other cycles of the standards, we have to follow the life cycle costing methodology that we have developed and we have updated for each cycle of standards. We have updated the weather files, we have updated the time-dependent valuation or the TDV values for both Base and REACH standards and then updated life cycle costing methodology. For this round of standards all of the people who have been participating have noticed it is a little bit different because we have relied heavily on the IOUs and the stakeholder meeting process to present and vet topics that are being presented in the staff workshops. Most of the topics that you have been hearing and you will hear at the staff workshops have been presented in stakeholder workshops several times, three, four, five times sometimes. So most of it should be familiar to you.

These are the workshops that we have already had this Spring, starting on April 4th. And June 9th is obviously today. And this is the list of the upcoming workshops. The big news here is that the June 14, 2011 workshop has been canceled. That was scheduled for next Tuesday. You know, our team has been basically working around the clock and the people haven’t had very many weekends and we have to give ourselves a break, too.

(Inaudible question from audience member.)

Here. They are July. And basically I’m going to ask the audience here. We have two dates, July 12th or

15th, I don’t know if there is a preference between those two dates. One of them is a Tuesday, July 12th, and July 15th is a Friday. So if you have a preference please let me know today and within the next couple of days we will make a decision which one of those dates.

We already went over the agenda for today’s workshop. Tomorrow is going to be mostly envelope measures both for res and nonres cool roofs, insulation. So if you are interested, please be here or you can dial in through the WebEx. June 21st is going to be a workshop. Martha is going to handle those and it is going to be residential and nonresidential ACM manual rule changes and updates. The mid-July workshops, which were supposed to be Tuesday, include a host of mostly residential topics, residential alternative component packages. This is basically the updated Package D, the 2008 Package D, which is going to be presented as Package A for that workshop.

But this is going to be the list of prescriptive requirements that we think are cost effective. Basically, this is a combination of the work we’ve been doing: zone air conditioning, higher mandatory measures for ceilings, walls and roofs, advanced envelope assemblies, HVAC refrigerant charge procedures, and nonres hotel/motel guest rooms, and residential and nonresidential changes to administrative requirements. These would be changes to the

Sections 10-101 to 114. And on July 21st and 22nd we will present the REACH standards requirements. This is a process that Martha is following to update the compliance software and this is the schedule that she is following and hopefully we can have our compliance software and the engines and the interfaces, everything ready well ahead of the effective date of the standards.

Forget that June 7th deadline. You know, please give us your information or this workshop by July 7th, so that gives you roughly a month.

That’s it. If there are any questions related to the introduction stuff?

(No response.)

If not, we will move to our next presenter, which is Eric Shadd from AEC and he will be talking about nonresidential fenestration updates. Thank you.

MR. SHADD: Good morning, everyone. Can you hear me okay? Yeah? Okay. I apologize for being late and holding everything up. I will jump right into it so we can get this going.

My name is Eric Shadd, I work for Architectural Energy Corporation and I’ve worked on the nonresidential and high rise residential fenestration update. So today a quick outline. We will go through the methodology, analysis and results that we did for this measure. We will go over the code language that is being proposed and any remaining work that we have to do.

So the first thing we did was conduct some research. We looked at existing standards, Title 24 90.1, etcetera. We also consulted a number of technical documents, market studies and online resources. We conducted many, many interviews of codes and standards developers, people in the fenestration industry and technical experts, all of this with the goal of gathering product information and typical practices as it applies to fenestration in California; also to develop a methodology and to gather stakeholder contacts. After this research was done we developed a list of products that could be applied to fenestration and we tried to be very exhausting in all the products that could apply, with the limitation that it had to be applicable to a prescriptive standard. And also from this research that we conducted we got cost information from manufacturer surveys. And as far as the research that led to our methodology, we decided to go with basically using an energy model to get the annual TDV energy for a representative fenestration. We would then develop a curve fit that would give us the TDV energy of any arbitrary fenestration given the U-factor, HSGC and VT. And with that we could get the annual TDV energy use of any fenestration and would be able to look at a very large set of fenestration alternatives. And finally with that curve fit we would use the life cycle cost methodology as it applies to TDV in order to get the life cycle cost of each fenestration alternative. And finally we also developed a list of stakeholders from all of our research that we performed.

So differences with the previous update, which took place in 2001, we have updated product costs, some technologies have become less expensive, we have a lot more products that we are looking at. We also examined SHGC as a function of angle of incidence. For those of you who are unfamiliar, SHGC is the solar heat gain coefficient of windows and it corresponds to how much heat gain you get through a window from the sun. And we also, as Mazi mentioned, had updated energy costs and weather files.

In terms of fenestration costs, all cost was looked at in terms of a cost premium over the baseline used. The raw cost premium of products was mainly obtained from California window manufacturers. In some cases we did use resources other than window manufacturers, glazing contractors, product manufacturers, or people outside of California if the technology was not prevalent in California. And in those cases we applied adjustment factors. And finally the fenestration cost, which was the entire, say, window assembly was just a simple sum of how much the glass cost, the frame cost, the spacer, etcetera.

So once we had all these different products we had to apply some selection rules to filter out certain things. First off, as I mentioned before, it had to be applicable to a prescriptive standard. So we looked at things like market availability, reliability, verifiability of performance data, and several other criteria to make sure that they could be used in a prescriptive standard. And also there were certain things that couldn't be done. In other words, you don't want to put a soft coating on the room side. If you are familiar with low-E coatings there are sort of two types. There are hard coatings and there are soft coatings. If you were to put the soft coating on the room side then it could be potentially scratched. So that was another way of filtering out the sort of combination of products that you could use together.

And then we had another set of selection rules and that was to find the representative fenestration that would go into our energy model. If you remember, our energy model was going to be the source of the curve fit, which would allow us to examine any arbitrary fenestration without having to use an energy model. Energy models are very time consuming and if you were to look at everything I think it would take on the order of six months of computing time. So this curve fit was a real big help.

There was an indexing algorithm that was generated based on those filters, the selection criteria that I mentioned before, and from that indexing algorithm we ended up with a set of about 1400 windows, about 600 glass skylights and about 55 plastic skylights. And the performance of these different fenestrations was calculated in CMAST, which is the new NFRC tool for determining U-factor, SHGC and visible transmittance, it’s a software tool. So there were no prototypes that needed to be mocked up.

For our energy model we were guided by – first off, we wanted to use EnergyPlus. That is predicted to be the new compliance software in the future so we wanted to use that for consistency’s sake. As I mentioned before, we used the CMAST tool to get the NFRC U-factor, SHGC and VT, the visible transmittance. In that way the standards could be consistent with what people can get in the market. We looked at the forecasted California construction by building type that was developed outside this analysis but it let us know how many building were going to be office buildings, how many were going to be retail and what sorts of characteristics do those types of buildings usually have. And that guided what we did with our energy model.
And also in line with that we looked at the Department of Energy’s reference building models of national building stock; and Title 24 2008 as well to get minimums for that;

and then some engineering judgment where it was necessary.

So with all that in mind in terms of the actual energy model, we used updated weather and TDV, as mentioned before, for all the different climate zones. For the envelope we used a 130 foot by 130 foot single story, single floor prototype. It was guided a lot by Title 24 2008 prescriptive minimums. The orientation was that it directly faced the cardinal directions. And we looked at windows and skylights at the window-to-wall ratios and skylight-to-roof ratios that you can see right here. We chose 4 x 5 and 4 x 4 because those are the NFRC 100 guidelines for when you are going to model these and find the NFRC performance ratings. And then within this envelope, of course, the windows, we used the representative fenestration that I mentioned before.

We had four perimeter zones, 15 foot deep, 100 x 100 foot core. The loads were guided by the ACM Manual. And then we included automatic bi-level daylighting controls in the primary, secondary, side-lit and skylight zones. And then the system we chose was a System 1, which turns out to be the most prevalent, it’s basically a package single zone, it is more around five tons.

So once we had done all of our energy modeling and we had our TDV energy use for all of these representative fenestration, we needed to curve fit structure that would fit the data that we had gotten from it. And we looked at the previous code update, we did some inspection of the data to look for trends, and we also investigated physical analogies, things like decay phenomena and such.

And this complicated thing that you see right here is the structure of the formula that we finally came up with. To talk about it in simple terms, it is simply a coefficient times the fenestration ratio, which is raised to a power, multiplied again by whatever performance rating you have from the NFRC value, also raised to a power, and then it is sort of the sum of all those together. And then a TDV baseline. And when we used this very extensive but useful formula we got very good curve fits.

This is pretty typical right here. I'm showing you an example of Climate Zone 3. This is calculated TDV from our curve fit versus modeled TDV which came from the energy model. You can see we have a correlation of somewhere around 98 percent and almost a 1:1 correspondence if you look at the slope of that line, it is about 0.98 and the offset is only about 0.06. So it was very close.

So after the curve fit was developed then all of these fenestration that were mentioned before, these 1400 windows, the 600 skylights and the 55 plastic skylights, were put into this curve fit. And we got the annual TDV use. Then from this annual TDV use we got the 30 year present value, the life cycle cost. And that was simply a multiplier that was given to us by the CEC. And then our final life cycle cost was the fenestration cost premium mentioned earlier plus the 30 year present value of the annual energy.

So the minimum life cycle cost, of course, was the fenestration that had the lowest life cycle cost. This is specific to each climate zone at each window-to-wall ratio and each skylight-to-roof ratio. So you have a different fenestration for each one of these. Every climate zone and every window-to-wall ratio and skylight-to-roof ratio has an optimum minimum life cycle cost. This fenestration became sort of the first basis for the standard but certain adjustments were made after this point.

So the adjustments were code simplification, as Mazi mentioned earlier, and for this standard we looked at using a single U-factor, SHGC and VT across all climate zones and across all window-to-wall ratios and skylight-to-roof ratios. We also did some code bounding. In other words, you don’t want to just say people have to have an SHGC of 0.22, you want to tell them that that is the maximum SHGC so they can actually do a little better than that, and such. And then there is actually a bullet point missing here. I guess maybe I accidentally deleted it at the last point. There were some stakeholder comments that led to some adjustments as well.

So for code simplification, there is a CEC move to simplify the code. As I mentioned before, we looked at single U-factor, SHGC and VT for all climate zones. The way we went about it was we looked at the lowest life cycle cost on a statewide basis. So we used the forecasted construction. And what we basically did was we took every single alternative that had turned out to be a minimum life cycle cost in the previous analysis and we put that into the life cycle cost formula and looked at what would be the entire impact on the whole state if that were the single fenestration chosen. And among all of those then we found the minimum from that.

In terms of code bounding, I think if you look at just the physical phenomena you can see that a maximum U-factor, which is basically a resistance – it's the inverse of resistance of a wall, if you want to think of it in terms of that way – a maximum U-factor, a maximum SHGC and a minimum VT sufficiently optimize the standard. If you go lower than the maximum SHGC that we will put in the standard then you will save energy. If you go higher than the minimum VT you will also save energy. So you can kind of just look at the physical phenomena and determine the bounce that way.

However, for plastic skylights, the pigment of a plastic skylight determines both the solar heat gain coefficient and the visible transmittance. So if you put a maximum bound on the solar heat gain coefficient you in effect put a maximum visible transmittance. And our analysis showed that VT actually had the most effect on the energy use of a building and that if you increased VT that you would always find energy savings above the minimum VT regardless of the fact that SHGC would also increase with it.

Here is an example of that. In Climate Zone 15, which is the climate zone with the highest heating load, you can see there both two percent skylight-to-roof ratio and five percent skylight-to-roof ratio; the overall TDV energy use always decreases with some slight little fluctuations in there. It either decreases or is neutral with increasing VT. VT is on the X-axis there. And I've highlighted the region of our proposed minimum VT. Now, if you also take a careful look here you will notice that it flattens out above the minimum VT. And I suspect that's why this became the minimum life cycle. What is happening there is basically the room is saturated with daylight and you can't get any more savings. But what happens is that, you know, for our energy model we had a specific lighting level. And if you go to any lighting levels higher than that this actually will not be flat, it will continue to decrease. So ours was based on an office occupancy. If you were to use a retail store, which uses a lot of light, then the curve would continue to decrease and not just flatten out at that point.

MS. BROOKE: Eric, I just have a clarifying question. In your model are you assuming that you can displace all of the internal lighting with the VT or is there just so much distance into the room? I mean, that's where you are getting your savings, right, is displacing interior lighting?

MR. SHADD: Right. I'm sorry, maybe I should clarify that. So the savings that come from VT come with daylighting controls. It's probably something I should have mentioned earlier. So if you have light coming through, say, a skylight or a window then you can adjust your electrical lighting downward from there and that's where your savings come in. Was that your question, Martha?

MS. BROOKE: Well, so my question is are you allowing – is your assumption that it can displace all of the interior lighting or just a certain amount into the room?

MR. SHADD: It depends on how many skylights you have in there. So I think earlier –

MS. BROOKE: Okay.

MR. SHADD: Yeah, right, right.

MR. SHIRAKH: There is a separate daylighting requirement in the code for the primary zone and the secondary zone. The illuminated areas that are within those zones will have to have some type of automatic control. So presumably the more VT, the more you can dim the lights within those zones. And this also couples with our controllable ballasting (ph), we are going to have dimming ballast that ramps lights up and down.

MR. GABEL: Real brief, Mike Gabel of Gabel Associates. To follow-up, so the controls are assumed to be dimming controls, not on/off controls?

MR. SHADD: They are assumed to be bi-level.

MR. GABEL: Bi-level.

MR. SHADD: So off 50 percent and completely on. Okay.

So the last form of adjustment that we did away from the minimum life cycle cost was based on stakeholder comments. So one of the stakeholder comments was that the proposed performance ratings cannot be achieved by all window types. So in our energy model we had fixed windows. But, of course, in the real world you can have operable windows, you can have doors that are made entirely of glass, you can have different types of operable windows, etcetera. So what we did was we revised again and we refined the standard again. And the way we did that was we used the same center of glass assembly and we put it into different window types.

So with our fixed window, for example, the optimum turned out to be a double-pane with green tint and triple silver low-E coating with, I think, an aluminum frame or something like that. So instead of just putting that into a fixed window we once again used CMAST and we put it into operable windows, we put it into curtain walls and storefronts and also into glazed doors. And we looked at several configurations within those window types. So for an operable window you can have a casement window, you can have an awning or a horizontal slider. So we looked at all of those. And we took the maximum U-factor of all those different configurations, the maximum SHGC of all those configurations and the minimum VT as well from those in order to develop a single standard, instead of having to specify a single one for casement, awning and horizontal slider, etcetera.

The next set of comments were mainly geared towards leaving lower VT as an option in the standard. Right now the standard only has a maximum solar heat gain coefficient. So our proposal is to now include VT so that we can see the daylighting benefits from fenestration. So the first comment was that we will encounter glare if we include VT in the standard. Our response to that was that the nonresidential VT that the stakeholder had observed has actually been lowered since this first comment from 0.52 to 0.44 for nonresidential. For high rise residential it has remained the same but we don’t consider that to be a concern because high rise residential is mainly unoccupied during the day, which is when glare is of most concern.

Our second response to the glare comment was that the prescriptive envelope approach is still available as well as the performance approach. If a lower VT is desired for the project clerestories can also be used in those two approaches. So we are not eliminating lower VTs from the standard. They can still be used in the standard. However, if you are going to follow the prescriptive envelope component approach, which is the part of the standard that we are revising, then you will need to follow this VT.

Another response is that there is an RSG formula in the Title 24 standards that basically allows you to lower your solar heat gain coefficient if you are using overhangs. There is not a corresponding overhang penalty on VT. Therefore, you can use sort of higher solar heat gain windows and still put shading over them and that will still be able to qualify without penalizing the VT.

Further responses on the glare comment, lower VT dos not mitigate direct sunlight contrast no matter how dark of a window you put in there. If you are looking at the disc of the sun through the window it’s going to be a thousand to one versus the rest of your surroundings. As far as reflective glare on computer screens, that can be mitigated with low reflectance computer accessories and we fully expect that the technology for anti-glare on computer screens is going to move much faster than the life cycle of a window installed in a building. And finally, occupant orientation can always significantly mitigate glare. This is especially true on east- and west- and north-facing windows. And actually right now 100 percent of the current nonresidential standard is susceptible to VTs that are higher than the proposed VT.

The next stakeholder comment was that exterior shading and interior blinds should be considered in the analysis. Exterior shading would actually tend to drive the VT higher. And for interior blinds, recent studies – as is cited here by HMG – show that occupants actually actively control blinds to maximize the daylight. And given that, if they have drawn down their shades, for instance, it’s actually better to have a higher VT so that more daylight savings, more daylighting control savings can be attained with those shades closed. So just to clarify that a little bit, most shades in commercial buildings are not the black-out type. You know, we are not talking about the blinds that you may have in your home that completely block out light. We are talking about shades that permit some light to come through, whether they are slatted or typically some sort of fabric or something like that or a screen.

And then another stakeholder comment was that the technology proposed in the standard – which is this triple silver, low-E coating that I mentioned before – is proprietary to only two companies. In our research we found that it is proprietary to two but available from four of the six major manufacturers. Only two manufacturers do not offer it. Those two manufacturers actually only offer the pyrolytic type of coating. Our second response was that Title 24 actually does not have a proprietary constraint, it has a cost effectiveness constraint and a market availability constraint, and several other constraints. But most notably what is really needed by law is to show cost effectiveness and market availability, which this technology does have, this triple silver, low-E coating.

And once again I wanted to mention that, even though this was the technology that was found to be optimum in the standard, it is not outlawing or eliminating any other technology, including maybe so-called exotic technologies such as electrochromic and thermochromic. Those can still be used within this standard in the performance approach or in the case of lower VT glazing, as we were talking before, and also in the prescriptive overall envelope approach.

Another comment was that effective aperture and LSG

– which is light to solar gain, the ratio of VT to SHGC – should be considered in lieu of VT. Effective aperture is actually being eliminated from the standards for the purpose of simplification. And LSG, which is the light to solar heat gain, would actually not guarantee that you would get good daylighting savings because even dark glazing can meet this requirement. You know, you can have a dark glazing that has a good ratio but still doesn’t let in much light.

And then finally, daylighting controls do not have a significant effect on savings. Our analysis actually showed that it did have a significant effect on savings and also, probably more importantly, almost all side-lit and sky-lit spaces will require daylighting in the new standards. So using daylighting in our energy model was appropriate, I believe.

I wanted to show some graphics here to show that if we do not include a VT requirement the losses to the standard are significant. This is a comparison of how much life cycle savings is lost if you don’t use VT versus if you do use VT. So in other words, for nonresidential windows you lose about 40 percent of your savings if you do not include VT in your standard. For skylights it is much more substantial as the benefit of skylights is almost primarily VT.

So finally, just to show some numbers here – I don’t expect us to read all of these – I kind of just wanted to show graphically the savings that we get from this new standard. So, as you can see, the minimum life cycle cost – which varied, as I mentioned before, by climate zone and also by the ratio of your fenestration to whatever surface you're looking at – and this proposed update that we have, the savings are pretty close, actually. You don't lose much by going to the simplified standard of single U-factor and SHGC and VT over the whole state. And then in contrast if you look at the no-VT alternative it drops significantly there. So this is showing nonresidential windows and high rise residential windows.

This next slide is the same thing but for glass skylights. For nonresidential plastic skylights, once again the minimum life cycle cost is very close to our proposed standard. There is no line here for no-VT because the VT requirement wouldn't apply to plastic skylights. And we have some final calculations to do, so high rise plastic and glass skylights, the data is not available yet.

So finally, our code language. This is what we are actually proposing for the standard. So we would have across all climate zones a maximum U-factor, a maximum RSG – which does correspond to SHGC with the exception of an overhang, which can adjust your SHGC – and we have a minimum VT. And they would be categorized, whether you have a fixed window, an operable window, curtain wall or storefront or a glazed door. And the overall maximum window-to-wall ratio remains the same. And once again the optimization procedure was based on a fixed window and we used the same center of glass that we found from the fixed window and the same frame type – I’m sorry, I should also mention that. Same center of glass and same frame type in terms of whether it was solid aluminum or whether it was some sort of thermally broke-in technology. And then we applied that same center of glass and frame type to the operable curtain wall, storefront, etcetera.

And then for skylights it is a similar story, maximum U-factor, RSG and minimum VT, with the exception of plastic, curve-mounted skylights, which will not have a requirement on solar heat gain coefficient per the energy saving benefits that I showed in that slide a few slides back. Sorry, this was for nonresidential, this is for nonresidential. And then Table 143(b) of the standards applies to high rise residential, a similar story here.

And finally, the remaining work we have is we need to still define exactly what the window types are. We will look into, you know, sort of different definitions that are available and look for what is most applicable here in California. We need to develop a default VT table. Right now in the standards there are default U-factors and default solar heat gain coefficients in the forms of tables and formulas. We need to develop the same thing for VT. And there are some guidelines there. We will almost certainly be using CMAST again for that. And then miscellaneous documentation of the work that was performed and some minor calculations left over.

So that concludes my presentation. Are there any questions?

MR. SHIRAKH: Thank you, Eric. I really like the simplification. You know, when you compare the Table 143(a) and (b) of this proposal with 2008 you will see how much simpler this is.

Any questions? Mike?

MR. GABEL: Mike Gabel, Gabel Associates. So when you talked about looking at all those numbers of 2000 products, a lot of them windows, some skylights, those are all NFRC-tested product. Were any of them storefront window types that were included or how did that work?

MR. SHADD: So what we did in our energy model – no, we used a fixed window type. And then once we found the optimum for the fixed window type then we used the same center of glass and the same frame type. We put that into a curtain wall and storefront frame inside CMAST and then got the VT, SHGC, etcetera, from that.

MR. GABEL: But, again, the assumption was that everything you looked at was NFRC-like or NFRC-tested product --

MR. SHADD: Um-hmm.

MR. GABEL: – that you assume would be readily available in the market anywhere, everywhere. I mean, just looking at those numbers they seem extraordinarily stringent to me with respect to what kinds of products people usually can obtain for typical office buildings. I mean, if you're doing a huge building you will have a special testing done and you might be able to do that. I'm just concerned about smaller projects and projects where they are trying to get off-the-shelf NFRC-tested product. And just looking at the SHGC values, they just seem, you know, pretty low. So just a comment.

MR. SHADD: Can I ask you a question, actually? Are you referring to it would be difficult for a smaller project to make a mock-up and then –

MR. GABEL: Well, for a smaller project they are not going to pay for testing a product, they are going to try to find product that has already been tested. And manufacturers at the local level are just not necessarily going to have NFRC ratings for a lot of glass types that, well, you are looking at as ideal in the abstract but in reality – I'm just commenting – it's just going to be kind of tough. I don't know how this is going to filter out with the performance method, to what extent you can offset this with other features. But just my first look at this, this is really quite a step.

MR. SHADD: So the one comment I will make in addition to that is that CMAST is a software tool and it is making it a lot easier to have windows rated. You would basically – there is a database of windows that is being created, windows and skylights, of course, that is being created right now that corresponds to these – well, anyway there is a database that is being created of all different sorts of window types. And it is really a simple matter if you use this software, you say this is the glass I want to put in, this is the frame I want to put in, this is the spacer and this is the gas and what is the rating. And you pay an agency to do that.

And the hope is that, as this method for rating window products becomes more prevalent and this library of windows grows that it will be as simple as what you're saying where you will just be able to say, oh, I'm going to use this kind of window in my building and it's already been rated and then we're done.

MR. SHIRAKH: CMAST has been up on NFRC's website for a while now. Have you ever tried using it, Mike?

MR. GABEL: No, I haven't used CMAST. And I'm not questioning the fact that it's a good piece of software that is readily available. The issue is that when you spec a project, especially smaller projects, they haven't really thought through precisely in most cases how they are going to meet the requirement. And so it's just this chicken and egg problem. I mean, it will drive the industry, obviously in theory, to looking at these issues earlier in the design process, which is what you want to do. It's just – this is getting back to CBA comments earlier, but education, that this is perhaps going to be a big issue in the first year of the standards for people to rethink how they are going to design and meet these requirements earlier on than waiting until the end of the process to figure it out, so to speak. So that's my comment.

MR. SHADD: Right.

MS. BROOKE: This is Martha. I just wanted to ask and then maybe mention as one more thing on your remaining work to do, is did you confirm that there are products already in the NFRC database that are certified at these levels for the different window types or did you assume that the products are available, they just haven't all been tested and people are going to figure out how to use this CMAST software to do that?

MR. SHADD: Well, in order for me to calculate these they already had to be in the database. As far as a complete –

MS. BROOKE: Okay, so all the large number of windows that you put in your regression equation were all from the NFRC database?

MR. SHADD: All of the products were already in the database.

MS. BROOKE: Okay, so maybe the only issues are with maybe these storefront windows or the other ones that are fabricated –

MR. SHADD: The storefronts were –

MS. BROOKE: – onsite.

MR. SHADD: – also – I guess we could talk about it in two different ways. So all of the products were available. So in other words, specific frames by themselves and specific center of glass assemblies and spacers and such, they are already in this database right here.

MS. BROOKE: Okay.

MR. SHADD: It's a matter of assembling them together into a complete product and then getting the rating from that. That is sort of the difference.

MS. BROOKE: Okay.

MR. SHADD: But every number I have in here comes from that.

MS. BROOKE: Okay, so it's the product versus the pieces then that we have to –

MR. SHADD: Right.

MS. BROOKE: That’s the challenge. Okay, thanks.

MR. RAYMER: Bob Raymer with CBIA. Martha just asked one of my questions. The second one is: Generically, as we’ve been mentioning at the past meetings, the question is with the proposed standards is there product available on a statewide basis, is there an adequate supply of product available on a statewide basis? And Mike has a great point. This also applies with, you know, some of the water stuff that we’re talking about and a few of the other systems. And that will be a big education and training issue that we’re going to have to get over here.

MR. SHADD: Yes, my response to that is that, as I mentioned before, four major manufacturers have this product. So it is readily available.

MR. CULP: Good morning. My name is Tom Culp. Hi, Eric. Eric and I have exchanged a few conversations but haven’t been in person yet.

MR. SHIRAKH: Who are you affiliated with?

MR. CULP: Birch Point Consulting. And just because I am new to this group I would like to just explain who I am a little bit. I’ve worked in the fenestration and glazing energy efficiency world for the last 13 years. I work with a number of the glazing companies as well as trade associations. And, while I’m not representing them here today, that is my experience both on the technology side as well as energy codes. I'm a voting member of the ASHRAE 90.1 Committee as well as have been heavily involved with IECC as well as their new International Green Construction Code and I sit on the NFRC Board of Directors along with Nelson (ph). So I've been involved in this area for a number of years and just wanted to share some comments.

So first of all I would like to thank Eric and praise him for the obvious hard work that has gone into this and really appreciate the fact that he is using modern tools like EnergyPlus and CMAST. So that's nice to see that coming along. However, we do – and many aspects of this, I think, are well done. But we do have some very serious concerns about at least one aspect of that and that is regarding the minimum VT. And so I would like to touch on a few points. We will be submitting detailed written comments but I did want to raise some of the points and questions.

First of all, it is absolutely wonderful that we are continuing to look at daylighting because that is incredibly important. However, our concern is that in the admirable effort to simplify by going to a simple minimum VT it's the wrong metric, it's overly simplistic. Daylighting is complicated, it is complex, particularly in commercial buildings. As an example, Heschong Mahone hosted a daylighting forum workgroup last year with over a hundred experts in the daylighting and energy code fields, specifically looking at how do you codify daylighting. And if there is one message that came out of that it is that it’s hard, you can't do it, it’s very difficult, there are many different approaches you can take. And VT is only one aspect, you also have to look at distribution of the glass laterally, up high, where is the light coming in, you have to look at the size of the glass.

You know, this analysis if you are looking at, say, a certain minimum VT is adequate at a 20 percent window-to-wall ratio, what about a 30 percent window-to-wall ratio that perhaps uses a darker glass but it’s bringing in the same number of lumens onto the work space. It’s actually doing a better job because it’s spread out m ore and it has a lower glare issue because less contrast between the wall and the glass. Yet a simple VT requirement like this would not allow that product to be used. So that’s just an example how daylighting is complicated.

And really I think something that would be of concern is that this has the potential to work against your goal and harm energy efficiency. You know, one example we already touched on a little bit, was glare. If you go to too excessive high VT are you going to lead to people closing the blinds and turning on the lights? That’s one and I know we’ve kind of had a little bit of dialogue about that. One answer is maybe using overhang. But if you use an overhang are we including that overhang in the cost analysis as well? I don’t think so.

But more one of my concerns – because I work with a number of glass companies and just in this field in general – is have we looked at the whole range of products and considered that this will introduce barriers to designs that save more energy? Now, there are a couple of examples. Have we considered what this would do with triple glazing? What if someone wants to do better than the code and put triple glazing in? They can certainly meet the U-factor and they can meet either the solar heat gain or the VT but not both. So this would prevent a barrier to the use of triple glazing. And I know you can go the performance path. But do we want to discourage the use of triple glazing? I don’t think so.

Same thing for these new configurations where you use two low-E coatings, a number two surface and a number four surface. That would not meet the VT requirement here. So we are discouraging some new innovative approaches. We talked about the triple-silver, low-E that is really kind of driving this VT requirement. Have we considered that some of the glass companies are developing new versions of the triple-silver, low-Es specifically with lower VT to try and balance glare and daylighting both? So you get that selectivity, the lower solar heat gain, but you’re balancing

VT. So it’s about having the right amount of VT, not the most VT.

What about a product that has lower solar heat gain than what’s listed here? It saves more energy overall, cooling. But it would not meet the VT requirement because you can't meet both, it is an overconstrain problem. This would not allow that. This would also introduce barriers to dynamic glazing, which I know one of the goals is to go to zero energy buildings. But this would introduce a barrier to the use of dynamic glazing, which is on DOE’s road map to zero energy buildings. The same thing for building integrated photovoltaic. Again those can go on the performance path. But do we want to introduce barriers to those technologies?

So, you know, and of course our savings – I don’t want to get the wrong message here. Daylighting is incredibly important. And savings that come from daylighting, as Eric mentioned, really come from the controls. And that was one question I think we need to look at. Have we looked at the relative energy savings from the daylighting controls versus the VT? You know, some of the work done by Rick Mistrick at Penn State, a daylighting expert, when you look at the savings that come from the daylighting design 96 percent of the savings comes from introducing the controls. The VT, whether you have low or high VT, adds another four percent. So it's, you know, relatively are we introducing all these barriers for something that is really a small incremental amount? And I think that's something Eric and I need to work through, is where these percentages came through and the impact with and without VT.

You know, there are some other questions I'll raise. Laminated glazing used for safety glass, that would not meet these VT requirements. So are we introducing a safety issue there as well? But again, you know, I don't want to sound too negative. It's just I think a lot of work and a lot of things we need to look at here. And we will be submitting comments and suggestions. You know, when you look at some of the base codes, whether it's 90.1 or IECC, they are tending to look at kind of VT, but not at this kind of level and not as a flat minimum VT, it may be a ratio. But look at the green codes. You know, California really wants to lead the way, so let's look at what the International Green Construction Code is doing or ASHRAE 189, which is now being picked up by all Army facilities for green construction. They are looking at effective aperture.

I know there is this concern of simplicity. Daylighting is not simple, though. And so I think if California wants to lead the way they need to look at what the green codes are doing and adapt that into the base code.

But this, in my opinion, is actually going the opposite direction. Now, if we do want to look at simplicity then let's look at some of the other possibilities, New Buildings Institute, a very proactive group, they helped rewrite a big change to the IECC, a 30 percent change. I know you've discussed that on the residential but there is a 30 percent change in stringency for the commercial side, too. And a lot of that was headed up by New Buildings Institute and AIA. They took a completely different approach, which is to introduce language about spreading the glass around and having a minimum VT over solar heat gain ratio, but at a much more moderate level and all in conjunction with lighting controls.

So I will include that in the written comments. But I think we need to look at some of these issues and try and work through the best solution that will promote daylighting but also not have unintended consequences. Thanks.

MR. SHIRAKH: What is your solution, get rid of VT, have a different level of VT, go to effective aperture?

MR. CULP: I think it was an admirable goal to try and simplify but going to a flat simple minimum VT there are all sorts of nuances and problems with that. So I think we need to go away from the minimum VT. Now, I'm not saying do no VT. The solution is either, in my opinion, to look at effective aperture. Maybe we can look at other ways to make that easier to use in the enforcement community. But effective aperture is a much better way to look at daylighting design. Beyond that, if we don't want to go that direction then there are other prescriptive ways that were talked about by the New Buildings Institute. It's more than just one simple number, but a couple of provisions that would then hopefully lead to better daylighting design but also with more flexibility to avoid these problems.

So, I mean, it's not something I can tell you right now but I will put it in our comments.

MR. SHIRAKH: Yes, I appreciate your written comments. Eric, do you have any reactions to this?

MR. SHADD: Well, no. I had a couple of things to say and I do look forward to reading the written comments. Like you said, this is something that is not just going to be able to be talked out right now.

The first comment was, you mentioned barriers to things like electrochromics and thermochromics. I don't see that this a barrier at all to those technologies. I don't think electrochromics or thermochromics are close to being part of a prescriptive standard and I think that pretty much no matter how the standard turned out now those would have to be pursued in the performance approach at this point. I don't think we are proposing a very radically high VT as well and I think 0.44 is reasonable. And finally, some of the groups that you've mentioned are mainly consensus-based. In other words, they are looking to find agreement among a committee which is composed of people with many different interests in the final product. Whereas, I believe this process is more driven by a cost effectiveness sort of criteria.

Yes, we will talk more offline.

MR. CULP: Yes, we will continue the dialogue. Just real quick regarding the numbers, just for other people in the room who aren't familiar with NFRC and all of that, you have to be careful about the numbers because it is not intuitive. Because the VT number includes the frame as well. So if you have a casement window it may have a 3.5 inch frame, the glass may have a high VT but because of that frame – you know, you say a 44 is not very high. Well, that may be true if you are talking about center of glass. But when you put that in a frame that is actually a very high number for some of these products.

MR. SHIRAKH: That's a good point. Because all the numbers here are for the total fenestration, it's not center of glass. Any other comments?

MR. SHADD: Sorry, if I could just respond to that really quickly. That's why we went to fixed operable and such and you can see operable is 0.33. And for the fixed frame we went with a wider frame than usual. So operable is

0.33. And you're right, these do represent whole window, yes.

MR. SHIRAKH: This is a classic example of simplicity versus flexibility.

MR. ZEREMBA: Tom Zaremba, I'm with Roetzel & Andress. I represent Pilkington North America AGC Flat Glass North America, two of the major manufacturers of flat glass in the United States. And I'll make my comments very briefly. I've been involved in all of the discussions of ASHRAE and IECC over the last several years relative to the introduction of VT issues into those codes and also at the new IGCC, the Green Construction Code, proceedings. And I've also been involved in the glass issues relative to building codes for at least the last 30 years, almost 30 years, as much as I hate to say that. But in any event I have to.

One thing I have found is that there simply is no silver bullet when it comes to, Let's pick one type of glass and use it everywhere, that's the way we're going to do things. And this proposal pretty much does that. It says we're going to have one type of glass everywhere in the state no matter what the climate zones, no matter what the orientation, no matter what the physical conditions, no matter what the design, no matter what. We're just going to have one type of glass in these buildings. There is no silver bullet. Glass is dependent upon a number of factors. And I think one of the most critical factors that was described came up during, I think, questioning by Martha here. And that was that the savings from VT is tied directly to lighting controls. The problem is that if the VT is high enough it lets in so much light that human override says shut the drapes, turn on the lights and override the controls.

Now what you've done by a high VT glass is you have increased the occupant's use of energy in that building. And, of course, commercial buildings are in very large measure driven from an energy consumption standpoint from internal lighting controls or designs. Look in this building. There is no VT whatsoever. The lighting is specifically designed in a way that it is the right levels of light to work in. A high VT glass in a commercial building is going to let a lot more light than you have in this building or in this room into that room. When that happens, if the human occupants are uncomfortable they will simply override the VT, they will override the lighting controls, they will increase the energy usage of the building by using artificial lighting instead of relying on the natural lighting. In addition to which you have the problem that if the discomfort of those occupants becomes such that the building occupants find it intolerable then you'll have aftermarket applications of films and other ways to reduce the amount of VT that is brought into the building.

So there are ways to address this. The codes are in the process of addressing it. Neither the IECC, ASHRAE or any of the green codes that I've been involved with have taken an approach that would be as simple as one which could ultimately actually increase energy usage. And, of course, that's why they don't take as simplified an approach as this because of their concern that if we do take this type of simplified approach we actually going to increase total energy usage of the building.

MS. BROOKE: Can I ask you a question? In your experience have there been studies done that shows that a certain level of VT does drive occupants to shut blinds?

MR. ZAREMBA: Well, the Times Building in New York City examines in intimate detail the interrelationship between lighting controls, shading and occupant comfort. So, yes, there are. And those are well known studies. I can tell you that I'm in a commercial office building with a 20 percent VT. And I've been in that building for almost 15 years. And what happens is the closing of the shades follows the sun around the building. And as a result all of the efforts to utilize lighting controls are overridden, even at 20 percent.

MS. BROOKE: Okay, thanks.

MR. SHIRAKH: It seems like you are okay with the U-factor and SHGC proposals. It's the VT that seems to be –

MR. ZAREMBA: Well, if you pull the VT out of this – I'm looking at this as a whole document. And so my concern is that these numbers evidently are intended to kind of fit together. When you do fit them together in these types you wind up with a single product. And my concern is that those relationships fail to take into account the climate zone you're in, they fail to take into account orientation, potential shading issues, human overrides. There are so many factors that I have not looked at SHGC separately to answer the question. I know these are extremely low numbers, the SHGC values are extremely low. And if you're in a climate zone even in California where you are in a heating-dominated climate these numbers are very, very low and they are going to leave an awful lot of energy on the table perhaps related to solar gain, to use that.

But, again, in many commercial buildings, particularly in the climate zones in this state, I think you're going to find that there is a very high level of dominance from an energy consumption standpoint from the use of electrical loads, energy, lighting loads. And that's my concern, is that these VT and SHGC numbers are almost guaranteed to result in override, human reaction overrides involving shading and overriding of the lighting controls to return to a lighting that is comfortable to work in.

MR. SHIRAKH: The previous speaker suggested going back to the effective aperture or some kind of simplified version of it. Would that be preferable?

MR. ZAREMBA: That is the most energy efficient way to address VT, SHGC and lighting, in my view. There are even simplified versions of that. The green codes have picked up effective aperture because they recognized throughout the discussion periods that if you truly want energy savings and reduced lighting loads effective aperture is the way to do it. The standard codes, the minimum codes picked up simplified methodologies in order simply to address the issue of lighting. And, of course, that was the New Buildings Institute and AIA developed proposals in the IECC, which come out in 2015.

MR. SHIRAKH: Can you include those in your written response?

MR. ZAREMBA: Oh, absolutely, we intend to.

MR. SHIRAKH: All right, thank you. George?

MR. SHADD: Could I have just –

MR. SHIRAKH: Yeah, we need to kind of move on to the next topic.

MR. SHADD: Okay.

MR. SHIRAKH: I only want to spend about five more minutes on this because we need to move on.

MR. SHADD: All right.

MR. SHIRAKH: Okay, Eric, can you quickly respond to that?

MR. SHADD: Well, I just wanted to say that the prescriptive standards are not intended to be a silver bullet for every application and that the prescriptive standards are intended to be an optimal solution for a reasonable number of buildings here in California and they have always been very specific in what sort of building they specify.

And also in regards to blinds, I think we answered that in the presentation. And in terms of solar gain, climate zones where solar gain is beneficial, we looked at that as well, we looked at passive solar gains in the colder climates. And it never turned out to be cost effective, even though some energy was saved.

MR. SHIRAKH: Cathy then George and then we go to a question online and then I want to move on.

MS. CHAPPELL: Cathy Chappell, Heschong Mahone Group. I just wanted to point out that we are dealing with effective aperture issues with the daylighting case work that both Tom and Tom have been involved with. And that may be Mudit Saxena, who is the case author, that is on the line. If we want to talk about that further we can.

Otherwise, we can respond to written comments and we've been working with Eric on those issues

MR. SHIRAKH: Okay, thank you, Cathy. George, quickly.

MR. NESBITT: George Nesbitt, Environmental Design Build, CalHERS passive house, California. I just want to bring up the issue of residential being in the nonresidential standards, a little oxymoronic since DHW and lighting fall then under the low rise residential standards for high rise residential.

The problem is on windows because of the low solar heat gain coefficient required because it is high rise, what that does is makes most high rise residential really hard, it makes the cooling budget, especially in a non-cooling climate, end up being 40 times larger than heating budget. We're talking about buildings that are not air-conditioned, don't need to be air-conditioned. If you take the same building and model it low rise versus high rise the TDV energy use doubles as a high rise. And so, you know, I think when it comes to high rise residential, A, it should not be in the nonres standards, B, windows should follow the low rise at least up until you get to maybe a certain percentage of glazing. I mean, if you want to build a high rise all glass building, you know, and do something stupid like that obviously you're more likely going to need that low solar heat gain coefficient.

And to kind of echo the previous commenter’s comment, the question is when it comes to windows and residential and possibly even nonresidential is it possible we’ve saved TDV energy yet actually not saved any real energy? So, you know, we increase the heating use, we decrease the non-existent cooling use, we’ve saved TDV but we’ve actually increased energy use over what we could have had.

MS. BROOKE: I’d say it’s not possible but that’s only my opinion.

MR. NESBITT: Maybe I’ll go noodle on the computer.

MR. SHADD: Okay, so in response to that, you said that it uses 40 times more energy. Maybe we can take a look at what models you used. In our models it sort of obviously did not do that. Another thing I’ll say is that hearing loads, you know, when you’re talking about TDV, electrical loads can be as high as 20 times – can have a 20 times higher value for electrical loads versus heating loads. I think for a high rise building to use 40 times more – I don’t know, I think we need to talk more about that and talk about the numbers.

MR. NESBITT: Yeah. I mean, I can show you real runs from real projects in real climate zones.

MR. SHADD: Okay.

MR. NESBITT: You know, four or five story.

MR. SHADD: All right, let’s talk more then.

MR. SHIRAKH: Thank you, George. There is a question online and then we will move on.

MR. SAXENA: Thank you. This is Mudit Saxena from Heschong Mahone Group. Can you guys hear me fine?

MR. SHIRAKH: Yes, we can.

MR. SAXENA: Okay, thanks. So I’ve been listening to the comments online and I’ve also talked with Tom Culp about his concerns about this. And I just wanted to make two small comments and then I will take myself offline so that you can move on. One was that we need to look at this thing in its entirety. We’re looking at the prescriptive portion of the code, which is requiring the minimum VT. I think that if you look at the envelope tradeoff method and also the performance method it allows you to get out of the minimum VT requirement if the designer so wishes.

The second thing I wanted to say is that we’ve looked at the issue of glare and blinds very carefully and there is a lot of research, a lot of effort that’s been done by us, a lot of it that has been done by others including the one that Tom mentioned, which is the New York Times study, which actually show that people are actively engaged with their blinds and they tend to open their blinds, they override an automatic signal to close blinds and leave them open more often than not. So everything that we’ve been finding out through this research – and this is a developing field – but everything we’ve looked at until now tells us that people actually like having more daylight into the space. And when there is a problem with glare they close the blinds and then they actively use those blinds to open it again to get back the view.

So we want to maximize the ability of lighting controls to work when those blinds are up. And what were trying to do here and what Eric is trying to do with the minimum VT, which really works very well for the daylighting portion of the code, is it provides a simple method for people to get good energy efficiency. There are other ways, there is the performance method which gives you an out as well. So I know there will be some comments from Tom, written comments, and I look forward to working with you on that, Tom and Eric. Thank you.

MR. SHIRAKH: Thank you.

MS. BROOKE: This is Martha. Just one quick thing. It seems to me that maybe what we could do to facilitate the discussion is for staff to combine the daylighting proposals with this proposal so people could see the entirety of the window. You know, because there have been these comments about effective aperture, well, we think we have that but we didn’t tell you about it. And that way you would know the entirety of what we're attempting here.

MR. SHIRAKH: Sounds like a good suggestion. I see a lot of heads nodding. If you have any other questions related to this topic we can probably come back to this in the afternoon during the public comment or you can send us your written comments and we will consider it. Thank you, Eric.

We're going to move to our next topic, which is the upgradable setback thermostats. And Josh is going to present that one.

MR. RASIN: So we will jump into this. It's the upgradable setback thermostats presentation. I'm a Josh Rasin with the Heschong Mahone Group. We have been working closely with Mazi and the Energy Commission. And just a quick overview.

This is our requirement for setback thermostats. It replaces the existing requirement for setback thermostats and calls them upgradable setback thermostats. The upgradable component of that language refers to the ability to add communication to the thermostat without the use of any tools. Communication will enable the end-user to shed AC load if they are voluntarily participating in a demand response program. With the removal of that communication it would function the same as the existing setback thermostats. This would require change in language of

Section 112(c), which is the requirement for space conditioning equipment and Section 150. And this does not allow for trade-off against other building features as required here. This requires a default of a four degree Fahrenheit setback by the UST in response to demand response signals but that setback can be changes, it’s user-defined, and it can be overridden anytime by the end-user.

So to do a little background here of why we’re talking about demand response. The purpose of the UST, the upgradable setback thermostat, is to help enhance grid reliability and prevent rolling blackouts which would knock out power in an entire neighborhood. These rolling blackouts only occur very rarely during really critical peak periods and no more than a few hours a year. It is not really economically feasible to build large power plants to meet this load for only a few hours a year. Demand response is a much more cost effective option. Additionally, the California utilities are moving towards peak day pricing, which changes the price of energy at different times of day to relate to how much they are having to pay for it at the wholesale level. So it this passes this cost of delivering power during these critical periods on to the consumer rather than average them into the summer rates, as is done now.

This creates an opportunity for consumers to manage their bills actively and save energy when it costs the most to them so they have the greatest savings. Studies have shown that enabling technology helps provide twice the load impact using a demand response program as just using pricing or incentives alone. Customer participation in the DR programs and events is still voluntary. No one is required to do anything but you are going to pay the price literally if you choose to do nothing. And so we are helping bring the UST in as that enabling technology.

MR. RAYMER: Could I ask a quick question?

MR. RASIN: All right.

MR. RAYMER: Can you go back to the last slide? And this is just the format of your slides. That last line is really important. When you print out what you've got on the CEC website right now the word "voluntary" doesn't appear. You see "customary participation in DR programs and events are" – end of page – and then you start the next page. That would be very important to get into that.

MR. SHIRAKH: Thank you, Bob. Good point.

MR. RASIN: Okay, thank you.

So why demand responsive thermostats? According to the CPUC, residential and commercial air conditioning loads represent at least 30 percent of the summer peak electricity loads so this is a great target for bringing down that summer peak. And the reference design that we're developing for the upgradable setback thermostat helps for demand response for all manners of appliances and devices, not just thermostats. Other loads are becoming more easily shed as a part of demand response. I've listed a couple of examples here of lighting, refrigerators, washing machines, power strips, all those sorts of things. You know, a refrigerator can turn off its defrost cycle or an anti-sweat heater and this requires a simple logic of a yes/no, is there a demand response event. And we're helping set the framework and the ground work to do this for not just thermostats but all over. We're just doing it via thermostats here. And this would help give the end-user multiple avenues of participating in a demand response event or demand response program to get the savings they want on these peak days by choosing what end use loads they feel they can shed most easily.

This is just the existing language, what is in the code right now under 2008 Title 24. It requires setback thermostats in all unitary heating and cooling systems, including heat pumps, that are not controlled by a central energy management control system. That's the same requirement that is triggering now. So in the same instances where you're putting in a setback thermostat we are now requiring this upgradable setback thermostat.

I want to give a little background. In 2008 there was a proposal for a PCT and this was a very contentious proposal. It had a built-in one-way communication using an RDS system, added an expansion slot to allow utilities to utilize a different communication method, and it required participation by customers in emergency events. And this was a big deal, this was not giving people the control they wanted over their own devices. And so what we’ve done for this code cycle is something very different. We’ve taken all these comments, we’ve taken these concerns and we think we’ve addressed them in a way that allows everyone to get what they really want out of this device.

So this is the 2013 UST proposal. There is no more mandatory participation in emergency events. There is no more mandatory participation in any events. Everything that is done by the UST is because the user decided they want to be involved in a demand response event. We added the requirement to allow for physically disabling the communication component of the thermostat. And we will get into the details of that in a little bit. But part of it is that the communicating component can actually be physically removed. You don’t have to enroll in a DR program, you don’t have to have the communication there. But a lot of people want that. You know, we have cell phones that connect to everything, they want to be able to control their thermostats from anywhere that they are. This allows them to do that.

We set a default demand response of four degrees, as I mentioned, but that can also be changed by the user. Maybe they are more comfortable with a two degree setback, maybe they want more savings and they want a six degree setback. They have the option to do that. As I iterated before, the participation in the DR program is voluntary, it’s their choice to do this.

So we did some technology surveys and the technology that would meet the requirements of this code would be in two basic configurations. One would be a plug-in interface where you have the removable communication device and USNAP is an example of a model that fits that description. Another option would be having a built-in communicating device, you know, it could be built-in Wi-Fi or Zigbee or Z-wave, whatever the person chooses. And that would have to be able to be turned off by a switch on the thermostat case. And that is an exception that allows this particular device with this built-in communication into existing buildings. The new construction requires that the communication component be removed completely if the consumer changes, but in existing buildings through a retrofit application perhaps you could put in a communicating device. And the idea there is that in a retrofit situation you have someone who is already living there, they know what kind of communication they want. If they want a Wi-Fi thermostat they can go get that. But in new construction it may be a developer who is developing this building and you don't know who is going to live there yet and so they don't know what kind of communication they might want. So you leave it as a port. The end-user can come in when they move and plug in whatever suits their purposes.

So we've done a couple of surveys and we found that communicating thermostats are currently available at a variety of price points. We sent out a manufacturer survey that had very brief responses and then we followed that up more recently with – we went on Home Depot.com and looked at what were the communicating thermostats that are currently available. And we found there is a seven-day touch screen programmable thermostat at price points of sixty and a hundred dollars. The sixty dollar one is just a standard setback thermostat currently meeting code and the one that costs $99.88 is a thermostat that has two USNAP ports and a Wi-Fi module included. So about a forty dollar price additive there to include this communication that would meet the requirements we're asking for now.

We also looked at another communication module that adds Insteon capabilities, which is a smart home automation network, and that's about $96.00 and it plugs in via a standard jack and can be unplugged also. So we took the average of these two points to get this $68.00 figure and that is approximately an incremental cost. Now this is what is currently available right now before there is any requirement for communicating thermostats. It’s reasonable that once this requirement goes into effect more manufacturers develop products that specifically meet this requirement and the product cost would come down, both in the near term, 2014, and the long term, 2020, 2030.

We estimated the effective useful life of 15 years. That is according to an older version of ASHRAE. The newest version does not have enough data to support an estimate of useful life of a thermostat. So for argument’s sake we’re sticking with 15 years. We assume with that 15 year life cycle we have to do cost analysis and savings analysis for the nonresidential and residential sector because this is affecting both. The residential sector uses 30 year TDV values, so that’s over 30 years. That’s assuming that you would have a thermostat for the first 15 years and replace it and another thermostat for the next 15 years. We decided to assume that after the first 15 years the incremental cost of this technology is going to be zero. It’s going to be widespread enough that we are already talking about 40 to 60 dollar adder. After 15 years that should be down to a couple of pennies at most.

So we made some basic savings assumptions to run the savings analysis. We started with the idea that customers are going to be on a time of use rate that has some sort of peak day pricing or critical peak pricing element to it. And that's the default rate, that is currently the default for many large commercial customers in IOU territories and it is going to be the default for residential customers in the future. We identified the top one percent of TDV hours, which made for 88 hours annually, and since those are the highest value hours those are the hours where the high price will be passed on to the consumer and therefore would be utilized as demand response events. We modeled the energy impact of a four degree setback during each hour. And then we made some assumptions about people participating. We assume that 70 percent of the customers are going to remain enrolled in this default rate as a time of use critical peak day pricing and approximately 30 percent will choose to opt-out. They will have an alternative that does not involve them in any demand response events.

So then of those 70 percent that are remaining in the event we assumed that on any given hour 10 percent will override what the thermostat is doing automatically. So for residential models we use MicroPass to model and we use Standard Prototype D and E, which is for the single family and multi-family dwellings. And we had to model it by climate zone. For the single family model we modeled this

Prototype D in every climate zone. We have the estimated electricity savings, demand savings, and the TDV dollar value over that 30 year life cycle that we talked about. For the multi-family dwelling we picked some sample climate zones that we thought helped show the range of weather in California and so therefore would be representative. There were some time constraints so we did that for every model other than the single family.

So as you can see here, demand savings varies, electricity savings as the kilowatt hours. And electricity savings and demand savings are one year, it’s 88 hours. And that is per thermostat. So the multi-family dwelling has eight units in it, each of those units is having this level of savings. And you can see in Climate Zone 5 the weather file shows very low cooling load that we are using and therefore there is no savings from adjusting your thermostat on a hot day. In all the other climate zones there is some savings taking place, you know, from $71 to $4000 in a single family.

This just shows graphically, the blue bars are the single family savings, the purple are the multi-family, and the green line – it’s a little small, it’s right at the bottom – that is the incremental cost, that’s that $68. So you can see in almost every climate zone the savings well exceed the incremental cost. And we’re talking about factors of two, three, seven to one and more. What that means is, let's say that the thermostat is not on one day or two days or three days of those 16, 20, 30, 80 hours a year. You still have enough savings from the thermostat shutting off when you are running the AC that it pays for this incremental cost.

On the nonresidential side we started with an office model that had three stories and five zones, a core zone and four perimeter zones. And this gave us a variety of options. It had different levels of glazing, different orientations, you know, the core has no glazing. So we could look at the average sort of effect on all these different types of office spaces. And then to get an idea of what would happen in the retail sector we changed the occupancy parameters. So we changed the density of occupants, we changed the equipment plug load, the lighting power density, all these different factors according to the nonresidential ACM for retail buildings to give an idea of what it would like in the retail sector.

And as you can see, here are the savings again modeled for these representative climate zones, 3, 6, 9, 12, 14 and 16. And we have savings again ranging from a couple of hundred dollars, and this is per thermostat. So the office model had 15 separate zones that we average across. So the entire building would have 15 times the savings because we are looking at each zone individually, each thermostat. And the reason we do each thermostat is that this is applying to unitary air conditioners. So one thermostat at a time, it makes sense to analyze it individually.

This is again graphic representation. The red line is the cost of the thermostat and the green and blue are the savings on a 15 year nonresidential TDV cycle.

So the actual language, what you've all been waiting for. So this changes the language to require an upgradable setback thermostat in place of the requirement for a setback thermostat previously. It requires upgradable capabilities. So it says right here, "UST shall not include onboard communication devices but shall have one industry standard expansion communication port that allows for the installation of a removable communication module." When you the module it will function normally as a normal setback thermostat and when you insert the module you will be able to receive demand response signals. And we identify how the response to demand response signals will be.

So we identify specifically price events. The default setback for the thermostat in response to a price event is four degrees Fahrenheit, it sets up four degrees Fahrenheit if you are in cooling mode, it sets down four degrees Fahrenheit if you are in heating mode. However, the occupant has the option of defining those set points as they see fit, as fits their needs. If there is an emergency event – and this is sort of in the situation where a blackout is imminent and we're trying to shed load to avoid shutting power off to everyone – the UST can respond to a specific offset contained in that emergency signal. The user still has the option to override and change that as they see fit. But generally we hope to never get in this situation. If we do we have the option of hopefully avoiding a blackout, which is hugely problematic for the economy and for the way the state operates at all.

So as I mentioned, the overhead function – all DR events, price and emergency events include a physical override function which when activated by the occupant restores the setback thermostat to the conditions immediately prior to that event. Here are some more details about what sort of capabilities need to be onboard and they are going to be described even further in the reference joint appendix, it's a technical reference document that will be distributed later.

So basically the expansion port shall be easily accessible to the occupant and you should be able to insert it and remove it without the use of tools. We don't want you to have to rewire anything or install your own communication module, this is just a simple pop it in and pop it out and you’re good to go. It should provide user information such as the type of event, whether it’s a price or emergency event. A lot of thermostat manufacturers will probably lean towards actually displaying what the price is so you can make an informed decision about how you want to react to it. There is a standardized terminal mapping. This is to help insure that the marketplace – you can put in a module that you want, you can go buy it at the store. Okay, I have this kind of thermostat, I know I want to be able to receive Wi-Fi, I want to be able to receive Zigbee, I want to receive a specific type of signal. Maybe they want to receive a signal for some sort of home network they already have set up. This will allow the market to develop solutions to meet everyone’s needs.

The ability to randomize. So one issue with thermostats is can be what’s called a rebound effect. Immediately after a demand response event everyone’s AC turns back on and you have a spike in load. The ability to randomize the setback after the end of the event prevents, sort of mitigates the effect of that rebound and sort of smoothes it out so that we still have energy savings overall. And as I mentioned, the capability for the occupant to restore the default temperature offsets and set points is included as a requirement for the thermostat.

So the existing exception is there for gravity gas wall heaters and room heaters, etcetera. Another exception is other devices that are approved by the Executive Director providing comparable heating and cooling systems and demand response functionality would be approved. That's a separate issue that would happen with the Executive Director after adoption of the code. And, as I mentioned earlier, thermostats that are installed in existing buildings or additions to existing buildings may be equipped with the onboard communication. It doesn't have to be a port, it can be built into the thermostat device as long as there is a switch that provides for the occupant to be able to turn it on and off without interrupting functioning of the setback thermostat.

Are there any questions?

MR. SHIRAKH: Thank you, Josh. Mike Hodgson?

MR. HODGSON: Mike Hodgson, ConSol, representing CBIA. Josh, just some general questions I think. The thermostat that you were pricing that was $96 at Home Depot does what you want in Section 112, correct? So it meets those standards?

MR. SHIRAKH: Yes.

MR. HODGSON: And the entity that is going to be sending out this signal is going to be the utility to do a setup, right?

MR. SHIRAKH: Yes.

MR. HODGSON: So in general, I mean, that's what the state is after is the ability to setup during peak loads. So have the utilities agreed to the technical description of these thermostats? Do we have, you know, Edison and PG&E and The Gas Company all agreeing to these thermostat requirements that you're proposing in 112?

MR. SHIRAKH: Well, we've had a lot of discussion with them and I think they are all onboard.

MR. HODGSON: Okay.

MR. SHIRAKH: I mean, Carlos is sitting there and, you know, he can talk on behalf of SCE. But the point that was made earlier, the cost to the builder is about $60.

MR. HODGSON: Right.

MR. SHIRAKH: So the ports, the inserts will be provided by somebody else other than the builders. So to you guys it's only sixty bucks. So the difference between what you're paying for setback thermostat and $60 is the cost to you.

MR. HODGSON: Right. I don't think we had a problem last go-round with this concept other than the political impact of it from other forces.

MR. SHIRAKH: Right.

MR. HODGSON: What we want to make sure is that we are not buying four different devices for four different service territories, that we would buy a single device that is readily available.

MR. SHIRAKH: The beauty of the concept of having – just buying a setback thermostat with an empty port is that this is truly a universal thermostat. You know, they can be sold anywhere in the state, be put in any service territory, the local utilities, SMUD, PG&E, SCE, they can provide a module that works with their system. And then the occupant can choose to put it in or remove it at their discretion.

MR. HODGSON: Okay, so we're buying a thermostat that doesn't have the module that allows –

MR. SHIRAKH: Does not have a module.

MR. HODGSON: – it to setup but it has the port that then a third party would give the occupant.

MR. SHIRAKH: Right, what you guys –

MR. HODGSON: – which the home building industry is not responsible for.

MR. SHIRAKH: – are putting in is basically a setback thermostat like you've always done with at least one empty port. It's up to the occupant to populate that with some kind of a module.

MR. HODGSON: Got it. Thank you.

MR. SHIRAKH: Tim? Oh, okay.

MR. STEINBERG: Hi, John Steinberg from EcoFactor. We very much agree with and support the goals that you were talking about, Josh, and the goals that we see the CEC trying to accomplish here, the idea of zero net energy homes, the idea of integrating demand response with energy efficiency. And nobody talked explicitly about this but obviously the reason why you want to do DR is for grid reliability. We strongly support the idea of communicating thermostats. We think that that’s a vital tool for accomplishing those goals.

But we are very concerned that this standard as laid out in Appendix JA5 actually will not help accomplish any of those goals. And I was very pleased to hear what you were saying, Josh, which I think is supportive of a lot of the goals that we’re trying to accomplish. But it seemed very different from what I got from the Joint Appendix, which I read for the first time about 36 hours ago. And reading the Joint Appendix sort of with a fresh set of eyes what the appendix told me, what I inferred about the goals of the people who wrote that appendix, was that a communicating thermostat is primarily a tool for demand response as opposed to other goals like energy management, which I will talk more about; that residential air conditioning loads can and should be controlled by utilities; that in effect only utilities should be able to connect to those thermostats; that a communicating thermostat, the communication aspect of a thermostat, has no real value to a consumer. And, sort of going along with that, the idea that energy efficiency just never appears anywhere in that standard as something that communicating thermostats can help with. And then, finally, the choice in effect that the standard creates for a consumer is that you can have a thermostat that participates without you as a consumer ever doing anything, that participates by itself in utility DR events, in effect has a mind of its own; or you can pull the radio out and not participate in DR events. But you can't have a communicating thermostat that doesn’t participate in DR events.

And I understand from what you were saying that some of the intention was different from that. But I think my interpretation of the document was very different from that intention. And I will say that we will absolutely submit written comments and I would welcome the opportunity to talk in more detail with you guys about the specifics of this. But I think the most important thing that is missing from that specification is the consumer value proposition. Why would a consumer want to have a communicating thermostat in their house?   I think from an individual self-interest standpoint the DR benefits of a communicating thermostat are not going to be compelling and are not going to be sufficiently motivating to get people to actually plug radios into these things once they are on walls.

Let me back up a little bit. We are an energy management service and we are optimizing communicating thermostats primarily for consumer benefit. We also do DR and I will just talk very briefly about that as well. But what we’re doing is saving consumers hundreds of dollars a year using a communicating thermostat with or without utility involvement. We have proven now – we have data that just actually got released today that shows that we are saving people between 15 and 20 percent of their HVAC spend with no loss of comfort and no loss of control. We use communicating thermostats to do that. It has nothing to do with demand response. If people pull the radios out because they don’t want to participate in DR we can't deliver that value.

On the DR side, one of the things that is very concerning to me about these standards is that it’s obviously trying to enable DR but the specific way that you’re going about that is in effect making permanent, locking into the hardware, a specific method for delivering DR, saying bump the temperature by four degrees for however many hours the utility sends a signal to the thermostat. That’s one way of doing demand response. It’s not the only way of doing demand response. And we, again, in our trials have proven that we can deliver significantly more load shed, 36 percent more load shed, than what you get with a standard four hour shift and at the same time have almost no effect on the temperature inside the home by doing intelligent pre-cooling matched to the individual characteristics of the home and the air conditioning system and the weather.

So we can do that but I think these standards are going to make it significantly more difficult for us to do that because in effect you're hard-wiring response into that thermostat. So we think the problem here is that – I think the way technology advances is if people understand and keep in mind that there are different layers to the stack. There is a hardware layer, there is sort of an operating system layer, and there is an application layer. And by embedding a specific way of doing demand response into the hardware is sort of the equivalent of saying all personal computers must run Wordstar for DOS. Yeah, when people first started using PCs that was a pretty good word processing program but technology has moved on since then.

We've come up with a much better way of doing demand response today. Someone else is very likely to come up with an even better way down the road. All you need to do, in my view, is say, Here are the commands you need to be able to receive: boost temperature, cut temperature, send data back. All you need at the hardware layer is the ability to send and receive signals. And then at the application layer it can be decided exactly how to do demand response.

So I think the fact that the specification doesn't talk about, doesn't deliver any kind of consumer value I suspect that – although obviously things have changed since the PCT from a few years ago and there has obviously been a lot of effort to avoid touching the hot buttons that got people so ticked off about the PCT last time – I don't think it's going to work. I think that because there is no consumer value proposition in the PCT as written and because it's going to be very clear to anybody reading this that the point of having communication is to let the utility come in and switch temperatures on your thermostat, I think you're still going to get a lot of pushback on this. And I think, even if we get to the end of the process with a specification like this and these communication modules and the standard is approved, consumers aren't going to want to put those modules in because there is no benefit to them. Some of the consumers who will put them in will tear them back out again because it's not doing them any good. And so in the end not only are we not saving energy or making the grid more reliable, you're not helping to put communicating thermostats out into the field.

Thank you.

MR. SHIRAKH: What do you mean by there is no value to the occupant? I mean, what is your proposal to change that?

MR. STEINBERG: Well, I think it would be difficult to write in consumer value, although there would be great value to all of us in this process to making it very explicit, sort of a statement of principles at the beginning of this that says, Your house is yours, your thermostat is yours, your air conditioner is yours, here’s a way, if you choose, other people can communicate, services you choose, people you choose can communicate with your thermostat. I don’t think it’s necessarily possible to add in consumer value into the specification but I think it’s very possible and will have no ill effect to strip out the things that are clearly, in my view, counter to consumer value and that don’t serve a purpose.

If you put into the specification everything that’s needed in order to communicate with the thermostat then what it’s done with the communication is a completely separate question. And as long as you can do everything you need to do, explaining all the ways that you are going to make people uncomfortable and inconvenience them, you don’t need to do that here.

MS. BROOKE: So you are suggesting that we stick to the hardware layer and not do anything in the application layer, is basically what you’re saying? No specification for the bump up or bump down as the default?

MR. STEINBERG: Essentially, Martha, yes. What I’m saying is specify that these are the places inside the thermostat that need to be addressable over the communications layer, these are the pieces of data that need to be sent out perhaps, these are the commands it needs to be able to receive. And why go any further?

MS. BROOKE: Okay, thank you.

MR. RASIN: Okay, John, I look forward to continuing the discussion later.

MR. SHIRAKH: Tim?

MR. SIMON: Hi, I'm Tim Simon, my company is Golden Power Manufacturing, Radio Thermostat Company of America. We make thermostats with radios.

Basically, I support what you have here. I have a couple of small points. One is that along the lines of what John said. When it comes to the terminals where you're dedicating which terminals go where it follows in my mind some of the logic that he has, that you're limiting what we can do to make these thermostats compatible with new, more modern ways of being efficient. Because you're saying the equivalent of you're going to build a watch, you're going to have an hour hand, a minute hand and a second hand, the whole thing is going to have a backlight behind it, and you're going to have to wind it so that it can last eight days. Now, I come out with a new LCD watch and you say, Sorry, it doesn't fit the code, it doesn't have movable hands and it’s electric, it’s not wind-able. So it can't work, sorry.

I think exactly the same as on the terminals, you should be saying, You must be able to hook up to a multi-stage heat pump, gas and electric, so forth, do all these things; how you do that is up to you. But you have to be able to connect to all these different things that are out there now. And don’t say we have to have this terminal here and there and there and there. It’s not terrible but it seems like a limiting factor and potentially a step back.

The other point I would make is more an informative point, some changes in the marketplace. When I first spoke here four or five years ago about this thermostats were thermostats that controlled an HVAC system and there was no connection to the outside world. Now we have the thermostat that we’re selling, the one that you’ve talked about at Home Depot, the $99 one, which comes really close to doing everything you’re saying right now. With the exception of the terminal and there is only some minor software and we do everything you say. So does it prove it’s possible? Yes. And it’s at 2000 stores across the United States and been there for the better part of a year. So it’s real, it’s not some hypothetical thing.

But the other thing that’s happened is there is a whole new world of people that want to talk to it. So the consumer is buying it because he wants to talk to it himself, he wants to take his iPad and say, Hey, I left my air conditioner on so I just turned it off. Or, I know I turned it off and I'm going to go home, it looks like the meeting is going to end soon, I'll turn the air conditioner on and when I get home maybe it will be cool enough for me by then. The other thing is that alarm companies are becoming gigantic users of thermostats. We will certainly sell more thermostats to alarm companies this year than if the Title 24 was in effect today that it would generate because of that. So there's all these different people that are trying to talk to the thermostat.

So the more that we make it so that we haven't put restrictions on it – because the worst thing in the world for me would be is there's one that works well with the consumer, there's one that works with Title 24 and then if the EPA comes together with their Energy Star there's one for that. So the guy goes to the store and says, Should I buy a Title 24 thermostat, should I buy an EPA thermostat or should I buy one that really seems to do more what I want? So the more we can bring that together – and the only thing to do to do that is to not limit the way it works, limit what it works with. Does it do the job you want it to do? And don't exactly make it so critical that this is how you achieve the job you need done.

MS. BROOKE: So you seem to be saying that we should stick to functional requirements and not prescribe solution sets.

MR. SIMON: Gosh, you said that in thirty seconds. That’s why you’re there and I’m here. Yeah, sure. I should have just come up and said that and then John wouldn’t have had to get up either. Yes, that’s what I’m saying.

MS. BROOKE: Thanks.

MR. SHIRAKH: I’m kind of still puzzled. What is it, the problems you have is the four degrees –

MR. SIMON: No, no. I don’t have any problem with that at all. I’m saying –

MR. SHIRAKH: Well, I think John did.

MR. SIMON: John did, yes.

MR. SHIRAKH: And the terminals, you know, terminals one to nine, that was an attempt as part of the PCT to kind of standardize. Actually, the goal was to have a standard plug and some manufacturers objected to that. I mean, it’s not going to break my heart if we give that up but it seems like it would be nice if that was standardized.

MR. SIMON: Here’s my answer to that. I answer about 150,000 calls a year – not personally – from our consumers who are installing thermostats. I would love to be able to say, You take this and plug it in here and you’re done. I mean, we get people that call up and say, Hey, I’ve got five blue wires coming out of my wall. And we say, Ah, you live in Tampa, Florida. Because obviously sometime years ago some guy in Tampa, Florida built homes and they had a lot of blue wire and just ran all this blue wire. So for us to have a standard it would be great. I just don’t see it being a reality today. And with some of the changing – like, a few years ago people called us when heat pumps were just starting to become really commonplace. Now we have people calling and saying, I have a heat pump with two stages of compressor and I’m backing it up with a traditional gas furnace that has two stages. Because the electric was so expensive with the aux heat came on. So now I need four connections. And I need it to be bi-fuel, gas and electric.

And I’m saying when you specify all those terminals be exactly this way and do those things it’s making it really hard for me to satisfy that customer, where I could satisfy him really easy if all you said was, It’s got to be able to work with multiple fuels, got to be able to work with multiple heat pumps, multiple stage, multiple furnaces. And then any mix that the guy happens to put together we can deal with. But if we’re stuck with this – we get back to my example of some day we’re going to look back and say the hands on the watch and the battery and so forth.

MR. SHIRAKH: So standardizing terminals one to nine, bad. What else?

MR. SIMON: I think of all things I’m really pretty happy. There may be some – there was one slide came up – and I’ll read them later – and it was a small word thing. I said, Yeah. But by and large this looks good. It looks good because it’s simple and it is not so confining. And obviously if I can do this, other people can do this. So it’s a doable thing. And, you know, when you mentioned the product for $59 at Home Depot without the module and you said ultimately that price will come down. That will come down. The thing that will drop more quickly is the price of the modules. The radio technology is becoming such that the modules are going to become cheaper and cheaper and cheaper and cheaper.

But I see purposes where people are going to want to have multiple modules in their home because they are going to say, I bought a security system and they set me up and I have a Z-wave radio in it and I really love it. And now in a couple of years this is going to come into effect and someone is going to say, I want to bring my house up to code, I’m remodeling some things and so forth. But now do I take out the Z-wave system that I had and do I put in the Zigbee system? So that’s why we took and had two radios, so you could have two steering wheels driving.

MR. SHIRAKH: Okay, so if we dropped the terminal standardization, Tim’s happy, right?

MR. SIMON: I would say, yes. I forgot those words, they were so great, that you used.

MR. SHIRAKH: Well, at some point, you know, the requirement – you know, like the four degrees – I mean, I must say this just didn’t come about –

MR. SIMON: I’m a hardware manufacturer.

MR. SHIRAKH: It was a long drawn discussion, there was a lot of policy discussions about that.

MR. SIMON: I don’t care about the four degrees, you know. That’s your -

MR. SHIRAKH: You know, we had to land someplace.

MR. SIMON: I think it’s a great place. I have no issue one way or the other. All I care about is how can we build the hardware so that the millions of thermostats we make can all become Title 24. Not that we make the street version as Title 24, in which case that will of course raise the price of it and lower the places it’s available. Because everyone is not going to want to carry multiple different things. But I like what you have.

MR. SHIRAKH: Thank you, Tim.

Bob, did you have a comment?

MR. RAYMER: Bob Raymer with California BIA. First off, reiterating what Mike said, our one concern right now and back in 2008 was to make sure the utilities are all on the same page. In 2008 there was a difference of opinion. Everybody seemed to like the idea but how they wanted to approach it was different. So as long as you take care of that issue, that is our overriding concern.

If I can be repetitive, it’s my understanding that what the Energy Commission is proposing is that the builder install a thermostat that is capable with its one or more ports to allow the occupant at some later date to take part in a utility program. So in essence this is the huge difference that exists between the 2013 proposal and the 2008 proposal.

MR. SHIRAKH: Exactly.

MR. RAYMER: We were pretty supportive of the 2008 proposal and we too sort of got hit by political lightning. Whether I was a true American was being questioned by some of our, you know, Southern California members. So with that it sounds to me like you’ve definitely got something here that can, from a public relations part, not trigger what happened in 2008. I just hope that very quickly you get on the front end of this and indicate that we’re just making these things user-friendly so that at some later date if they want to get involved, there you go.

MR. SHIRAKH: Exactly. And, again, just to reiterate, the proposal would be for a thermostat that is exactly like the setback thermostat that has been going in the homes up to this point with one unpopulated – at least one unpopulated – port that the occupant can choose to populate based on the utility territory where they live.

MR. RAYMER: Perfect. Thank you.

MR. SHIRAKH: And they are in total control of it. And so I'm hoping that's very clear. Jamy?

MR. BACCHUS: Jamy Bacchus, National Resources Defense Council. I just want to bring up something that almost everyone has kind of brought up in bits and pieces between today's meeting and last week's webinar. If the IOUs are providing the modules and we're leaving it to the manufacturers to dictate whatever standard they want to do, is there going to be a mismatch in the future? How do we know that PG&E will stock two or three different modules? Is this a concern?

MR. SHIRAKH: Tim, can you come up?

MR. SIMON: This is a subject that we talk about a lot. Our customers, like Home Depot, have said as soon as there is a reason we'll stock the module if anybody wants it to be available. Where there is a demand there will be the supply. We already make Zigbee, Z-wave and Wi-Fi modules. And whether the utility sells them, I don't know. When people said that I kind of went, I don't know if the utility necessarily gives it away. The utility could say if you're going to use our system you have to have this module. Like years ago the phone company said when they opened up and you could buy your own phone, they said it has to be FCC-approved and has to have an RJ-11 jack and beyond that we don't really care. The utility says it has to plug into the thermostat and has to communicate in this manner. If you buy it at Home Depot or you buy it from us or whoever else, I don't see why anybody cares.

MR. SHIRAKH: So essentially the way we wrote the technical specifications is that it leaves it open, that it can be Wi-Fi, can be Zigbee, can be USNAP, can be USB. You know, we're letting the industry decide all of that, we're not putting any restrictions on it.

MR. SIMON: Well, I think, Mazi, along that line if I was a thermostat manufacturer and I made a thermostat with a receptacle that there were no modules for the market would put me out of business very quickly. And people would say, Well, you don't buy that one, you can't get the radio for it. So buy the one you can get the radios for.

MR. BACCHUS: If a customer wants to participate in a program – this was brought up earlier – why would the customer want to put this in if it's just going to be benefitting the utility or the state? They need to know that their utility bills could come down. And if the utility is selling to them or a thermostat manufacturer is selling it to them for a certain price I think you're going to get less people participating in the program than if the utility decides, You sign up for the program, here is your chip and they plug it in.

MR. SHIRAKH: I mean, those are all the good questions, you know, some of the comments, but we can’t really put that in the code language.

MR. BACCHUS: Yes.

MR. SHIRAKH: That’s an educational effort by maybe us, the utilities. But, you know, this workshop today is about the technical specifications of the thermostat. You know, customer education, utility incentives, I mean, those are all the things we need to address in the future.

MR. BACCHUS: And I agree, Mazi. I think it’s more if we leave it up to the market, which I think there is a benefit to that because different technologies and one will play out to be the winner. But if we don’t know which one that is, we don’t pick a horse, are there going to be dead thermostats out there that customers who want to participate aren’t going to have the ability without ripping the thermostat out?

MR. SHIRAKH: We don’t think so. Because the way – again, the thermostat has a port and the port can support many number of different technologies. So we’re not deciding that, all we’re saying is that it must be able to support these different communication systems.

George?

MR. NESBITT: George Nesbitt. So if I go out and buy a thermostat when this regulation is in effect I will have to buy one for my existing home that meets the standard, correct?

MR. SHIRAKH: Only – no.

MR. NESBITT: That has the capability?

MR. SHIRAKH: For an existing home?

MR. NESBITT: For an existing home.

MR. SHIRAKH: No, only if you pull a permit. You know, if you're doing a major retrofit.

MR. NESBITT: Pull a permit for changing my thermostat?

MR. SHIRAKH: No, that's not what I'm saying. I'm trying to explain.

MR. NESBITT: Okay.

MR. SHIRAKH: If you're doing like an HVAC change-out, you know, you're replacing the outdoor unit, the furnace and all that, then you have to pull a permit. If you do that then you have to upgrade your thermostat. At that point you have a choice. You can either put the thermostat that we were just talking about with an empty port with no communication gear onboard or, in existing homes, you can actually buy a thermostat that has a communication device onboard which is compatible with the local utility. And it’s up to you which one you want to put in.

MR. NESBITT: Okay. So it’s essentially like the duct testing, refrigerant charge change-out.

MR. SHIRAKH: Whatever triggers those will trigger this.

MR. NESBITT: Right.

MR. SHIRAKH: In existing homes you have two choices, that’s what I’m trying to say.

MR. NESBITT: Yes. Although I don’t think the code says it’s triggered only if you pull a permit. So the question is, the thermostat needs to be controlled but does it need to be the thermostat where that control is? I mean, why could you not have a device that you wire into the thermostat wiring that would control the thermostat from remote from the thermostat as opposed to having it have to be either built in or plugged in at the thermostat? Because you may not have the ability to – or, you know, it can become hard, you know, got to pull more wire or you got walls closed and, you know, do you want a little wart on your thermostat? So is it what we want is the thermostat to be able to be controlled but can it not be controlled from somewhere else within the thermostat wiring circuit?

MR. SHIRAKH: Well, there was an exception that he put on, you know, if is it an equivalent device that can perform the same functionality could also be approved. That’s why we had that second exception in there.

MR. NESBITT: Okay. Because by that I would think perhaps any thermostat currently on the market would then have the ability to be controlled. Although maybe I’m missing something in that it would not have the ability to be totally controlled.

MR. SHIRAKH: You’re talking about the existing homes, you’re thinking that if you operate through this device you have to run extra wire. That’s what your concern is, right?

MR. NESBITT: Yes. And also the concern of having to constantly change your thermostat because the standard has changed or, you know, different communication ways. Whereas, if the thermostat is controlled somewhere else in the circuit and it’s telling it to shut off because – you know, maybe it still does need functionality to tell a device somewhere else within the circuit what temperature it’s set at right now and whether it’s running or not. But, you know, I’m thinking rather than having – you know, what you’re saying is only if we pull a permit or a new construction we have to have this device. But then we have in the market thermostats that are non-communicating and thermostats that are communicating. And either we’re going to, you know – it’s –

MR. SHIRAKH: That's why we have that second exception in there. I mean, you're talking about the hypothetical products that might come into the market. I think we can address it. But as far as this UST that we're considering, it can accommodate different communication protocols and operates through the communications protocols. That's why we went this route. So it's not really necessary to change the thermostat itself as the technology changes, we think, we hope.

MR. NESBITT: Right.

MR. SHIRAKH: And all we need to do is basically replace the module to operate. So I think we just need to – if there are other situations then we will look at them.

MR. NESBITT: Yeah. I'm just thinking that, you know, while there is nothing wrong with having a thermostat that has that functionality built in, what's wrong with just having a regular thermostat we have and it can be added, rather than having to run out and buy different thermostats all the time. I mean, if you've already got one and it works.

MR. SHIRAKH: Okay, thank you.

MR. NESBITT: I don't want to see that ruled out.

MR. SHIRAKH: Any other comments related to this?

MR. WARE: We have one more comment on that.

MR. SHIRAKH: Well, I think Albert, do you have a comment?

MR. CHIU: Albert Chiu with Pacific Gas and Electric Company. So first I would like to address some of the questions in the audience. What is the IOU perspective on this? Obviously, I am only representing PG&E.

MR. SHIRAKH: You need to talk into the microphone, we can’t here you.

MR. CHIU: Sorry. Is it better?

MR. SHIRAKH: Yes.

MR. CHIU: So first, all the IOUs in general support the UST case study. But in the details on some of the technical details I would have to say that we are still in – there are still slight disagreements on some of the technical specifications and how we should proceed. So in overall high level off-hour (ph) use won’t support this but there is still discrepancy on some of the details that we are working with the Energy Commission and see if we can get them resolved. And hopefully we can in the future, that all our use would be hundred percent agree on everything of this case study. But that’s not the case at this moment.

Then at the same time, you know, I do want to again – you know, PG&E recommendations are just focused on the technical specifications in high level so that we allow the different manufacturers to provide a higher flexibility and creativity on introducing energy management system and home energy products and thermostat in the future. So we have discussed this many times, I just want to point it out since that seems to be the manufacturer desire as well.

MR. SHIRAKH: Thank you, Albert.

I think there is a question online.

MR. WARE: Yes.

MR. OATMAN: Can you hear me now?

MR. SHIRAKH: Yes, we can. Thanks.

MR. OATMAN: Good. Hi, this is Kirk Oatman, I Am in Control. That's the name of the company, not me. Just very briefly, we offer a highly intelligent energy management system and we were very involved in the drafting of the Open Hand Standard that Albert and some of the folks he works with were closely involved in.

Just very briefly, first of all the general approach is great here and we strongly support it. We did some work with Gary Flamm on the lighting sections of this work and actually moved some of those to be more functionally oriented than precisely prescriptive and that seemed to have worked well. So there have been a couple of comments about going in that direction and I think that would have value to everybody and make some of the discussions easier indeed. One small detail, there are multiple DR providers in the market now. And on the Open Hand Committee we spent tens of hours of discussions talking about supporting multiple DR providers in an environment of either small commercial or home. So the phrase which speaks just of utility as sending a DR signal is probably a bit limited at this point.

And the people from – Tim and the person from EcoFactor covered a lot of the other points that I would make about having these thermostats support energy efficiency or conservation, as you wish to call it, in addition to DR. And, again, on the Open Hand Standards Committee we spent a lot of time on those issues, moving frankly from the thinking three or four years ago, which was totally DR oriented, toward overall energy efficiency. Because quite frankly, as you say, DR is one percent of the hours of the year and all the rest we really should all be working toward energy efficiency.

So I think that there are a few places where we would want to incorporate that so that these thermostats will be effective for the 99 percent rather than just responding to only very limited DR signals which wouldn’t give us the opportunity to achieve those savings.

And just one quick comment on the wires. There are products now which essentially move the control aspect of the thermostat right down to the heating units and all of the interfaces and logic are done elsewhere. And that is going to become more and more prevalent in actually a very short number of years with the EMS, you know, such as ours, such as EcoFactor. Because we can do all of the logic that is done to operate stages and so forth in our system. So I think, again, moving toward a more functional description in that area as well as some of the others would have value and, again, make the standard more flexible, more agreeable to everybody and make these discussions faster.

MR. SHIRAKH: So you're saying make the standards more flexible. I want to know specifically what that means. The only thing we actually have in the requirement besides the four degrees are a set of override functions and on/off buttons, which we felt it was necessary to put it in there. But besides the four degrees, what else is there in the current specifications that is hindering flexibility?

And my second question is, you know, several speakers have said this needs to address energy efficiency not just DR. I don't know what that means. What is it that we need to do and how is this preventing energy efficiency? I mean, could you address those questions, please?

MR. OATMAN: Sure. Again – and we don't want this discussion to go on a terribly long time, but a couple of the points, actually, I think the person from EcoFactor made. One is that the limitation that either you have communication for DR or you don't says that – intersects with the fact that there are people who will want to have energy conservation facilities in their premises but maybe not be enrolled in DR programs. So they want the communication in the thermostat but they are not involved in DR programs.

And also the fact is that all you're prescribing in here for the communication is a very limited set of messages to the thermostat which says I am in an event and you kind of infer but don't specify it's an emergency event or a fairly standard DR event. But that doesn't give the facilities for the energy conservation products to say, All right, I want you at 72 degrees now, I want you at 73 now and I want you at 74 now, say, as people are coming into an office in the morning or something like that. So the specification here says this is all that somebody has to do to meet Title 24 and all that it's going to do is enable DR. And if somebody will have already spent money on this thermostat they're not going to spend money on a different thermostat that has the additional very simple commands for the energy efficiency controls.

MR. SHIRAKH: May I comment on that?

MR. OATMAN: Yes.

MR. SHIRAKH: These are minimum requirements. There is nothing to prevent you and manufacturers from making thermostats have more capabilities, there is nothing in there that prevents that.

MR. OATMAN: That is certainly true.

MR. SHIRAKH: So the question here was, you know, the State of California has a summer peak demand problem, we’re trying to address that. We’re not trying to solve all the problems in the world with one device. And what we’ve said is that the device you put in the house by the builders will have these minimum capabilities. In fact, many manufacturers already have different product lines. And, I think, Golden Power is one of them. They have everything from Yugo to Cadillac. And all of them comply with our requirements. So we’re not preventing any of this from happening, it is really up to the market, you know, the builders, the manufacturers, the utilities. You know, if they want to put in something that is better than Title 24, more power to them. We’re not preventing that.

MR. RASIN: One other point. I think it’s important to mention that this requirement for the UST is triggered in the absence of an energy management control system. If there is an EMCS you’re not required to have a UST. So if you have an EMCS that can do DR and energy efficiency and all the other things that you want, you don’t have to do this.

MR. OATMAN: True, when this is triggered. But the point of this, you say you don’t have to have this if you already have an EMS in. But most premises will be getting this thermostat which says it is upgradable and then they will upgrade to the communication facility that you specify in the standard. And at that point then is when either a small business or a home would add some sort of EMS capability. So unfortunately you have one before the other and then reverse for that part of the discussion.

MR. STEINBERG: John Steinberg from EcoFactor. If I could jump in for a second. One thing is the EMCS reference, I saw that in there but I didn't see that defined anywhere in the appendix, I missed it.

MR. SHIRAKH: Well, that is not in that. The different sections of standards, we didn't present all of it. That actually, I think, is in Section 120 or 121 of the standards –

MR. STEINBERG: Okay.

MR. SHIRAKH: – which is the nonresidential mandatory requirements. And that states that if you have an energy management control system you do not need a UST.

MR. STEINBERG: The other thing I was just going to add is that I think the problems that we have with the specification, I just want to stress, I think they're actually fairly easy to solve and I think most of what you have in there is actually fine and it's really just tweaking some words about sort of mandatory versus permissive and that sort of thing.

MR. SHIRAKH: Yes

MR. STEINBERG: And so I would be more than happy to work with you to sort of illustrate how we could address our concerns without changing –

MR. SHIRAKH: I understand that.

MR. STEINBERG: – what you already have.

MR. SHIRAKH: But the point that I was trying to make, that these are minimum requirements and we do not prevent devices that have more capabilities. As long as the meet these requirements, they can do more.

MR. STEINBERG: If we can make the language more explicit to make that clear I think most of my issues may go away.

MR. SHIRAKH: Yes.

MS. BROOKE: We would love to work with you on that, yes.

MR. SHIRAKH: All right.

MR. OATMAN: This is Kirk Oatman. I would be happy to work on that, too. Again, with the background on Open Hand we talked through all of these exact same issues. So I'd like to participate.

MS. BROOKE: Great, thank you.

MR. SHIRAKH: Okay, thank you. Carlos has got a comment.

MR. HAIAD: Carlos Haiad, Southern California Edison. I think one thing is being missed on this entire process here this morning. Even if the customer has a communicating module, that was at one point provided by the utility, as long as he doesn’t register with the utility we have no control. We actually even have no visibility of that. It’s almost a two-step process. He has to engage us to potentially get that module and once he gets the module he has to register that device into our network. And none of this just occurs by magic.

So to that point that there is no benefit to the customer because he is not participating in the DR program, he is going to pull the communication out, he’s not. He can use that communication as a way to do energy management. In fact, you know, that is not only the communication with the utility, it has to occur within the thermostat. You can have a gateway that has the communication with the utility and the gateway then talks to multi-point user devices in the home. If that communication exists for the purpose of one of the voluntary programs that the utility might offer in the future they should be able to leverage that for energy management big time. There is nothing to prevent that whatsoever. Nothing at all.

MR. SHIRAKH: Thank you, Carlos. Albert?

MR. CHIU: Albert Chiu with PG&E. So I agree with what Carlos said. I just want to add that at this moment, at least for PG&E, we have not identified exactly how to communicate with PCT in the future. Our business model has yet to be determined. So are we going to ship out modules? And if there is multiple modules there, are we going to have stock on all of those or are we going to provide rebate for customer to purchase it in retail channels? Is it an upstream channel or a downstream channel or are we just going to offer the rates to the customer and let them invest in enabling technologies? None of those has been determined.

So I just want to point out that, even though we are supporting these codes, we are not, you now, committing ourself into providing the module to our customers.

MR. SHIRAKH: Thank you, Albert. Any other comments in the room or online?

(No response.)

Okay, so we are about 45 minutes behind schedule. Why don’t we take an hour and come back at a quarter to two and then we will get on with our afternoon.

(Lunch recess until 1:45 p.m.)

A F T E R N O O N   S E S S I O N

1:45 P.M.

MR. SHIRAKH: Good afternoon. We're going to start our afternoon session. Yanda is going to present two topics. The first one is going to be multi-family domestic hot water/solar heating systems. So we will start with that.

MR. ZHANG: My name is Yanda Zhang with Heschong Mahone Group. The first topic I'm going to present is multi-family DHW and solar water heating. In this topic I will basically look at what are the options to improve domestic hot water system designs in multi-family buildings but also including hotel and motel buildings. And this topic used to be separated into two and there are many stakeholders being in-house, so a lot of detail are being discussed. In this presentation I just want to go over the overall approaches and the results and proposal. And you can find more details in the CASE report and many of the details are also in the previous stakeholder meeting presentations.

So the general approach is here. We want to look at what are the options to get the maximum savings we can achieve for multi-family buildings. So we look at three levels of potential improvement. In level one we only considered the distribution loop controls, recirculation loop controls. In level two we also add the possibility of improved recirculation designs. And in level three we add another component which is solar water heating and look at overall cost effectiveness at all those three levels.

The technical aspect includes three components. First is the recirculation system controls. And there are a couple of control technologies out there and have been in the field for many years, evaluated and tried by utility programs. One is demand control and the other is temperature modulation and also continuous monitoring is also a technology, you know, that has been proved to be able to save energy even though it is not a control technology. And the second technical area related to this proposal is the recirculation loop designs. I want to, again, kind of repeat it.

We’ve talked about this before and there has always been some confusion related to this topic. Right now in the code there is absolutely no requirement in a sense of what design you should have for recirculation loops. And how to deal with it is definitely a challenge because in most of the buildings it’s really be implemented in many different ways. So that’s why before it has not been addressed. This is really a first step attempt in a sense to try to guide industry towards future and better improvements. The general approach is first we have a proposed design that kind of reflects the market practice, to in a sense set the reference so we can compare what performance we can achieve. And then on top of that we have a standard design but that will reflect an improved design. So that basically in a sense sets the requirement, what your design should be, at least in the code cycle.

And the third is the solar water heating, which is a very mature technology. You know, the issue related to implementing is always cost effectiveness. And also we discussed the issue of if you don’t install solar water heaters, what about getting your building ready for future installations. And we also look at, you know, what is the cost saving potential of that.

So going back to this loop design again – the reason I want to repeat is I feel this is the one that constantly has been discussed and asked, there are potential design confusions about it. So at the bottom I’m showing three graphs. On the left you can see in a real building what the recirculation distribution loop can be. It’s fairly complicated. And that’s also one of the reasons why you have, you know, such a huge amount of loss associated with distribution. Now, in the middle picture we are showing what about we set a default design, something in that structure. So that basically sets a reference what the loop would be. I mean, compared to the real building on the left you can see that the default design is really already a streamlined design. So if we use this default design to simulate your building energy consumption it’s really a very conservative estimate of your heat loss. So your real building heat loss can be definitely much larger.

And the standard design has a slight difference from the default design in that instead of using one big loop you are using two small loops to support the building. So to summarize, when the building design is submitted for compliance – and you can have three options, one, you can input your own design, which is basically specify six pipe sections. And your user design will not be as efficient as the default design because the default, as you can see, is already a very streamlined assumption. And the second option is, if you don’t want to put in a specific user option you can just use the default design, which is also – you know, if you can compare the pictures – not bad in a sense, already not overestimating your energy consumption. So the third is if you want to use the default design, if you think, you know, we can meet the standard design, then we are potentially saying we propose that you need a verification. And the residential will be HERS and the nonresidential will follow the NR appendix, the NR guidelines.

And in terms of controls and the energy savings the proposals are based on multi-year PIER research on this subject. And, you know, we have been doing field monitoring and studies in more than 30 buildings. And, you know, the study also found that on average the recirculation loop consumed more than 30 percent of your total DHW energy consumption. In many buildings it can be much more. So it is an important issue to address. That's also why savings associated with it is also large. And the methodologies were used as estimated savings and is based on the models that we developed under the PIER program and the models being fully validated with field-measured performance as well as the plumbing designs.

So here is a summary of those two buildings that we used in our cost effectiveness studies. Basically, one is low rise and one is high rise. There are more details in the report. So the first step, we said there are three levels, right, and the first level let's only look at the control, what are the savings potential and how cost effective it is. And control really relatively speaking is cheap, $1000 for equipment and $200 for installation. You know, roughly you have a 15 year life and it could be longer. We assume 15 years. So here is the basic life cycle cost analysis result.

In the level two we said we are going to add the streamlined designs to require two loops. You know, the benefit of two loops is you would be able to use a pipe with smaller diameters instead of using, you know, big fat pipes. There is really no cost associated with that. In fact, you are actually going to save substantially with your plumbing costs because the pipe will be smaller. So the amount of copper in a sense that you use will be less.

Switch to the solar side and the cost of solar, we discussed the details in stakeholder meetings. You know, we collect the costs from variable sources and here is the summary of it. And also we consider within the 30 years what about the replacement costs. For example, over here we assume collectors have a 20 year life but in reality, you know, a lot of people would argue that flat plate collectors can last longer than that. But nevertheless we assume you're going to replace it in 20 years. So almost the same – you know, after 20 years you almost would consider the cost of reinstalling the solar system again. Along with this many other details of replacing solar tanks and pumps and all that.

So this is the result of picking a climate zone as an example. It depends on the size of solar collector. The cost effectiveness result will be – they're different. The main reason is as you are sizing big collectors the overall effectiveness will be reduced because in summertime potentially you are going to have overheating problems and overall efficiency will be in a sense reduced. Basically, it’s more, you know, the smaller in a sense the more efficient. However, if it’s too small, you know, you’re not going to get a lot of energy savings. So by running detailed analysis using Transis (ph) we would be able to find basically the threshold for different climate zones where the solar water heating along with other measures will be cost effective.

So to summarize here for different climate zones that’s what we find. For low rise and for high rise, ones using the base TDV value and the other one is using the REACH TDV values. And here it specifies the solar savings fractions under which the level three will be cost effective. So above that, you know, the measure is not cost effective. Another important factor is, since we are going to propose prescriptive requirements what it basically means is that the demand control plus the optimum design plus the solar water heating is really trying to set a performance budget. Because we expect almost a hundred percent of the multi-family designs will follow the performance approach instead of the prescriptive requirements.

So because of that we do need to address what are the alternative compliance options if we decide not to do control, not to optimize the design, not to use solar water heating. So here is a summary of results showing for each climate zone what would be the option of not doing the proposed solar water heating instead of using, for example, high efficiency water heaters and high efficiency cooling and heating equipment. And I'm just going to explain here a little bit. This is the TDV energy savings if you use those options on the left. The high efficiency water heater, the assumption is that instead of using 80 percent efficiency water heating using 96 condensing water heater. The high efficiency furnace will be same, instead of using standard using condensing. High efficiency AC instead of using SEER 13 using 15.

And using those assumptions what we find is – let's go here first. First of all, those options are cost effective. The life cycle costs are negative, meaning the overall cost is less than the base CASE design. The second is that with these designs those will be the TDV energy savings you can achieve. Those TDV energy savings represent those percentage of hot water heating TDV energy budget. So in a sense this here is the proposed solar water heating fraction. For example, for Climate Zone 1 we propose you have 20 percent solar water heating fraction and if you don't do it, if you implement all those high efficiency alternatives, then you will be achieve 23 percent of the water heating budget. So you will be able to beat the budget set by the solar water heating requirements. So basically we're showing that there are alternatives, you don’t have to do it.

And the other issue related to this solar requirement is the adequacy of roof areas, we are showing here, for different story buildings. We are saying even at the level of, you know, 0.5 or 50 percent solar fraction you really looking at a very small fraction of roof area to achieve this energy savings goal. So it is feasible and can be achieved.

So this is the proposed code language. This will be in the Section 151, which is the prescriptive requirements. Basically, the addition to the code language is the solar water heating system with solar fraction specified in Table 151-C. And then adding that the recirculation system should be equipped with demand control and has a two recirculation loop. This is kind of the improved recirculation loop design we talked about.

MS. BROOKE: Yanda, could I interrupt you for just one minute. This is Martha. Several slides ago you had a table that showed, I think, the TDV savings and you had all three of these proposals. Are you grouping these together when you’re doing your savings analysis?

MR. ZHANG: Yes.

MS. BROOKE: So if you’re grouping those together for your savings analysis and then you were just talking about you could do a high efficiency water heater in place of solar, are you saying in place of all three of these or just in place of solar?

MR. ZHANG: Just in place of solar.

MS. BROOKE: Okay.

MR. ZHANG: Now, what I did not talk about, for example, is the control side. In all of the early slides there was more than one control technology available, right? So when we say prescriptively we want you to have demand control, it’s also the intention that we don’t want the code to only demand using of one technology. So we want to have the code in a sense technology neutral, only use the demand control to set the budget. And people can use other controls.

MS. BROOKE: But they have to use the performance approach.

MR. ZHANG: Yes.

MS. BROOKE: All right.

MR. ZHANG: Right. So this is the prescriptive requirement part. This is the solar fractions that we are proposing for each climate zone. And some of them – Climate Zone 15, the desert area, is showing that it’s very cost effective, it’s actually cost effective at 65 percent. And also, you know, it can be replaced with other measures at high solar fraction. The reason we set that 0.5 is that we don’t want to cause basically overheating situations.

MR. SHIRAKH: Yanda, you're showing solar fraction of 0.40 in Climate Zone 16 for solar. Is that a problem for such cold climate zones? Is there a maintenance issue involved there?

MR. ZHANG: Well, when we had the stakeholder meetings and I think this was talked about from the very beginning. You know, the information we get from people is, you know, the industry collectively has addressed those issues in the past couple of years. Although there is not one single standard but there are definitely different types of technologies to address the safety issue. Basically, our feedback is, you know, there are technologies being able to address that issue.

MS. BROOKE: The one thing that I would make a comment on at this point is that we are trying to move towards more consistency across climate zones for our prescriptive requirements. And so I see, you know, multiple levels of solar fraction. So we might talk about what do we lose if we just get it down to one or two levels instead of multiple levels across climate zones.

MR. ZHANG: Yes.

MR. SHIRAKH: Going back to my question for a second, then what you're saying is technology has improved to the point that freezing is not an issue?

MR. ZHANG: Yes, freezing protection technology is mature now.

MR. SHIRAKH: Okay, thank you.

MR. ZHANG: John, please.

MR. MCHUGH: So, Yanda, for these solar fractions do these reflect a particular square foot of collector area per square foot of dwelling units? I mean, it looks like Climate Zone 15 has a higher solar fraction. It might be that there is actually some consistency in terms of design consistency. Could you describe how that relates?

MR. ZHANG: Why we picked the 0.5 for Climate Zone 15?

MR. MCHUGH: Yes.

MR. ZHANG: Versus low of others. Good question. You know, first is the cost effective analysis. We are showing here – for example, going back to Climate Zone 15 – is that it can be cost effective even if you have 70 percent solar fraction. But we didn’t pick that high number. The thinking is that if you pick at the high level one is how you can alternatively using other approaches, if you do not want to use solar water heating. So this goes back to this table. We basically set up the levels based on what are the alternatives, the limit that the alternative method can achieve. So this is where it came from. We are basically saying by using high efficiency HVAC and hot water heating equipments those are the level of savings. By the way, those are the cost effective measures. You can always go SEER 16 to achieve higher but that’s not what we included here because there would be cost effective issues. But we only considered the cost effective alternatives.

MR. MCHUGH: And what is high efficiency air conditioner, what SEER are you looking at?

MR. ZHANG: 15.

MR. MCHUGH: 15. Thanks.

MR. ZHANG: Okay.

MS. BROOKE: Just to clarify, they have to do all three of those high efficiency air conditioner, high efficiency furnace, high efficiency water heater?

MR. ZHANG: Yes. Well –

MS. BROOKE: Oh, if it says yes, they have to do all three of them?

MR. ZHANG: Right.

MS. BROOKE: Okay.

MR. ZHANG: Okay, this is the section of the code proposal, is the solar water heating ready part. Well, basically, it suggests mandatory requirements that, you know, the following items shall be labeled and showing on the plan for permit. And those items are in the following slides, they are related to solar-ready components. Let’s just go over the overview. A is the adequate in a sense roof areas or other areas for solar collectors. And B here is the solar tank areas to accommodate future installation of solar storage tank. And C is the plumbing requirement, not really asking to plumbing them now instead of asking you to ask people to have the conduit pass be specified for future installation. And also the same thing here is specifying conduit between the solar tank and water heater. Basically we want in the future to not only have collector area being prepared but also you prepare that plumbing can be relatively easily done between solar collectors and the solar tanks and solar tanks and auxiliary water heaters. And the exception to all those mandatory requirements is that if you are going to install – if you install solar water heating, obviously, none of those apply.

Let’s go back to some of the details. Again, what is the solar zone, roughly roof area we are requiring. The difference between solar zone – not the difference, let’s just say the solar zone potentially can be on your roof or can be in other spaces on the building site, for example, a shaded parking. So the basic requirement is that your solar zone should be 1.5 percent of your building conditioned floor area or 30 percent of your total available roof area, whichever is smaller. So in a sense the maximum we require you is to have 30 percent of your available roof area. The available roof area excluding areas that are shaded by existing trees, utility poles or other buildings. So it’s only unshaded, they are being required to have 30 percent or less to be ready for future installation. And the second requirement is the solar zone shading requirement. This is more or less the same as we proposed for other CASE studies, we coordinated with other CASE studies for res and nonres solar-ready measures. They are pretty much the same. And the third is also similar to what we proposed for other solar-ready requirements to include the consideration of fire access.

So this is my presentation.

MR. SHIRAKH: Thank you, Yanda. Any questions for Yanda from the audience in the room? Mike?

MR. HODGSON: Mike Hodgson, ConSol. This is not the presentation that was on the website last night. So I'm just wondering is it now currently posted at the website?

MR. ZHANG: We did make some slight change, yes.

MR. HODGSON: Okay.

MR. ZHANG: So I think –

MR. SHIRAKH: Yes, we will replace what's current with this.

MR. HODGSON: It's awkward to look at one, try to get ready for one and then have something fairly significantly different in our opinion. The data that I would like to see and I didn't see in your presentation or in the previous presentation is the cost data. So you're saying that solar hot water is cost effective. And what assumption did you make on the cost of the solar hot water system?

MR. ZHANG: Well, not in details, but this slide, for example, showing the cost curve, the installed system cost versus the size of the collector.

MR. HODGSON: Okay.

MR. ZHANG: And the next slides, you know, we have talked of in 30 years what you can expect to replace and the cost of those – let's see, is this one, maybe this is not the – oh, this is the lump sum of what would be the maintenance costs, including replacement of parts.

MR. HODGSON: One of my concerns, as an example on this slide, you're looking at life expectancy of motor and pumps.

MR. ZHANG: Yes.

MR. HODGSON: I'm not that up to speed on multi-family solar systems but in the single family world the pumps are not – there is no warranty that I'm familiar with greater than three years. And typical longevity of a pump on a solar hot water system like a Tyco(ph) or any of those that are in the market today are less than five years. So I'm wondering where some of the data comes from on this. Like, in a collector, the photovoltaic collectors are warrantied now for 20 years. I don't know of any solar hot water collector that's warrantied for 20 years. So are you making those assumptions that if you have it in life expectancy that you will have the market warranty it for that period of time

MR. ZHANG: Not based on the market warranty, it's based on industry data.

MR. HODGSON: Okay.

MR. ZHANG: So we can definitely share that with you.

MR. HODGSON: Okay. So could you kind of dissect then what you think the cost of – I don't know how large a solar hot water system you're looking at, again that's difficult to tell. Is this a 16-plex, is this a 12-plex, what building are you looking at? So then go to your slide that then says this is the cost of the system, which is hard for me to interpolate.

MR. ZHANG: True, it's not all detailed here. But if you go, for example, from here it tells you – let's see, do I have it here? I guess unfortunately here. But it does have – for example, this is the prototype building we're talking about, right? One is two story and the other is four story. And from the conditioned floor areas you can calculate what is the expected hot water demand, daily demand, right? So in general in the solar industry they basically size it by the daily demand and then multiply a fraction, 0.5 or 0.3. So they basically use that fraction to size accordingly.

MR. HODGSON: We’re just trying to be able to figure out what you’re talking about. And I apologize, it’s not clear to me because it’s the first time we’ve seen a lot of this data.

MR. ZHANG: Uh-huh.

MR. HODGSON: But I’m just trying to take your two story example here. It looks like it’s a 40-unit complex, right?

MR. ZHANG: Uh-huh.

MR. HODGSON: So that means I’m going to have a roof area of around 24,000 square feet, if I just kind of extrapolate what I would know about multi-family. Then you want 30 percent of that 24,000 square feet roof area as clear space.

MR. ZHANG: No. What I said 1.5 percent –

MR. HODGSON: Okay, 1.5 –

MR. ZHANG: - up to 30 percent. If it is more than 30 percent we say stop there. But 1.5 percent.

MR. HODGSON: So we have a 40,000 square foot building, does that translate into, what, 600 square feet at 1.5 percent?

MR. ZHANG: Let me see, I go back to this.

MR. SHIRAKH: About 360 square feet, if my calculator is right.

MR. ZHANG: Yes. This might be a table that it can have a better reference. This is what we are saying. If you size your solar collector to meet 50 percent, solar fraction would be 50 percent, for two-story building you need three percent of your roof area. For a 20-story building you need 28 percent of your roof area.

MR. HODGSON: Yeah, I apologize. I don’t care about anything three story or more. That’s my personal reference, all right.

MR. ZHANG: Okay, is that –

MR. HODGSON: I’m just trying to figure out if I have a four-story building then I need four percent of my –

MR. ZHANG: Six percent.

MR. HODGSON: Excuse me, a three-story building, four percent of my footprint. If I have ten units on the first floor, ten units on the – so I have a 10,000 square foot probable roof area.

MR. ZHANG: Uh-huh.

MR. HODGSON: On a three story, so I need four percent of 10,000, right?

MR. ZHANG: Right.

MR. HODGSON: That’s 400 square feet. So I need somewhere clear on my roof 20 x 20.

MR. ZHANG: Right.

MR. HODGSON: And you've looked at that and said that that's a reasonable thing to do on three-story multi-family buildings?

MR. ZHANG: I think –

MR. HODGSON: I mean, I've been on a lot of three-story multi-family buildings, there is no clear space on a multi-family building at three stories with all the vents, okay?

MR. ZHANG: First of all, you have collector size is not big chunk of piece of 400 square feet. It's obviously, you know –

MR. HODGSON: This is not clear space, this is just individual spaces that could add up?

MR. ZHANG: You can, you can.

MR. HODGSON: All right. So I think this needs to be a little clearer.

MR. ZHANG: Okay.

MR. HODGSON: Because we don't understand it or at least, let me speak for myself, I don't get it. And I think the presentation needs to figure out how much this costs and where these things need to go so that we can respond to what you're asking.

MR. SHIRAKH: It sounds like we need to have a discussion with Mike and Bob about this topic.

MR. ZHANG: Right.

MR. HODGSON: Okay.

MR. SHIRAKH: Your CASE report should have more of this detail, right?

MR. ZHANG: Yes.

MR. SHIRAKH: Can you make that available to us?

MR. ZHANG: Yes.

MR. HODGSON: Okay, thank you.

MR. SHIRAKH: Bob?

MR. RAYMER: Bob Raymer with CBIA. When you were gathering data from manufacturers and you asked them about the life expectancy, did you follow-up with a similar question of what do they warranty that same component? I mean, if they are telling you 10 years for the motor and pump, did you ask any of them what they actually warranty these components for?

MR. ZHANG: I don’t – first of all I have to say I did not personally collect that. I would not say – probably better to say we want to get back to you. Because actually it is a combined effort. (unintelligible) had a couple solar studies, actually we kind of coordinate together, had conferences with industry.

MR. RAYMER: We got a quick education on this about seven years ago with the passage of SB1, where at one time the sponsors of the bill and industry felt very comfortable putting into the bill that if you’re going to get state money put in a requirement, a warranty requirement of, I think it was either 15 or 20 years. And then all of a sudden the industry had a conniption fit over that. They did not like a 15 or 20 year warranty. It was very difficult to get them to agree to a 10 year.

MR. ZHANG: Uh-huh.

MR. RAYMER: Now, obviously I'm assuming that there has been advancement but now we're talking about water heating and those components. You may have instances of the motor and pump lasting 10 years but they don't warranty it for that. And the same thing goes for the collectors.

MR. ZHANG: Let me also ask this, I guess, fundamental question to everyone. I think a lot of – for example, you buy HVAC, we have cost analysis, it goes to 10 years, 12 years. It does not mean industry they say I warrant for 10 years.

MR. RAYMER: Some systems are required by law – you've got a three, five and 10 year warranty minimum, certain structural things with the house, it has a 10 year warranty by law.

MR. ZHANG: Again, my question is that just because they don't provide a warranty for 20 years doesn't mean we –

MR. RAYMER: Doesn't mean that it won't last, I agree with that. At the same time, though, it should be cause to alarm if they have a warranty that is much, much smaller than the useful life that you may be assuming. That may be a sign that you're probably going to be replacing this twice during the life of the building.

MR. ZHANG: Yeah.

MR. SHIRAKH: John McHugh.

MR. MCHUGH: I would just like to comment that if you look at the – you know, we typically assume ballast life of 15 years for lighting ballast and typically those aren't warrantied past five years. So that's a situation where the warranty is a third of what we expect the rated life to be. It's not that surprising that many manufacturers are not willing to warranty long past essentially the issues of initial failure because there are so many issues associated with how the product is operated that it can have an effect on its product life.

MR. SHIRAKH: Any other questions?

MR. NESBITT: George Nesbitt. Can you go back to the default design slide?

MR. ZHANG: Yes.

MR. NESBITT: So the default design is the Package D, the –

MR. ZHANG: The standard design.

MR. NESBITT: I'm sorry, I'm sorry. Standard design is Package D, okay. So the default design is assuming something worse than the standard design?

MR. ZHANG: Right.

MR. NESBITT: Now, what if reality is worse than the default design?

MR. ZHANG: Most of the time it is worse or can be much worse usually. But again at the beginning I was saying this is really the first step. We hope that we can provide some guidance here. Realize that requiring check in plan and design is really a complicated job for building officers and for builders, too. So this is a first step. We realize that, yes.

MR. NESBITT: So on average if someone doesn’t want to touch a button they’ll take the default design and we’re going to give them more credit than they likely deserve because most of the pipes are exposed in the parking garage below the building.

MR. ZHANG: You’re right.

MR. NESBITT: And so we’re going to underestimate energy use. Now if they decide to check a button they are still being compared against the standard design and then they will be punished for bad design.

MR. ZHANG: Well, yeah. The first is if you take the default design we give them credit, not really. We are not reflecting their true energy, yes, that’s right. When I say that is because right now in the code you input whatever your design is and that’s your standard design. So it doesn’t matter how bad or how good design is, you’re not getting credit and you cannot get penalized. So this approach is basically here saying, If you take the default design you know you get a slight hit because you are not meeting the standard design, even your building can be much worse.

MR. NESBITT: Right, but if you take the default design you’re not necessarily inputting your actual design.

MR. ZHANG: You’re not.

MR. NESBITT: Okay.

MR. ZHANG: You’re not. So if you really want to put the actual design you can do that. So by looking at this picture on the left you know that in real buildings you will not be able to beat most of the time the default design. So if you do think you did a good job, well, you can say, My building is same as the standard design, so you not get penalized. Then it will be exactly the same as today, as the 2008 Title 24.

MR. NESBITT: I would imagine that most duct systems that are not tested hopefully test below the 28 percent we assume in the default design. So it seems like we’re giving credit where credit is not due. So in the prescriptive package approach, prescriptive path you either have to essentially do the standard design, best practice, or you can trade it off for various components.

MR. ZHANG: Right.

MR. NESBITT: Most of the multi-family projects I work on do not have an air conditioner. So are we going to make them put 15/16 SEER air conditioners in every unit where they don't have them, don't need them?

MR. ZHANG: Let's talk about this.

MR. NESBITT: Because most of the buildings only have air conditioning possibly for the office and some common areas.

MR. ZHANG: This is what I'm showing here. Most of them – I'm assuming you're talking about those climate zones, right? I'm not even considering you have an AC. The prescriptive requirements assume you don't have AC to work with.

MR. NESBITT: Okay.

MR. ZHANG: But you have heaters, right? And you have hot water heaters, too.

MR. NESBITT: Well, and you have various by building. So now because the standard design is the Package D requirement and when you do performance path that's what you're compared against. So Tom Conlan has accused me of being very consistent and so I will stay true to that and get back to high rise multi-family. Typically it is a central system so it's going to be compared against the standard design, best practice. Whereas if it was individual units we would still be compared against individual water heaters in the unit, which does happen even in high rise multi-family, correct?

MR. ZHANG: The language is – yes, it’s only for you have a recirculation loop.

MR. NESBITT: Right.

MR. ZHANG: If you don’t, you have individual systems, this does not apply.

MR. NESBITT: Okay. So high rise multi-family in part because of the low solar heat gain coefficients in the nonresidential standards is relative – is in comparison hard to get above code.

MR. ZHANG: Um-hmm.

MR. NESBITT: You have no HERS credits other than duct testing basically available to you currently. And then we have CTACC, the California Tax Allocation Credit Committee, which now requires you be a minimum of 17.5 percent above minimum code. So we’re going to compare you against the absolute best system here and water heating is usually –

MR. ZHANG: Right.

MR. NESBITT: - pretty significant part of your budge. And now it may be very difficult and expensive to get there. Now, I do have affordable housing developers that are –

MR. ZHANG: Actually, George, what do you do today?
MR. NESBITT: - installing solar hot water. What do I do today?
MR. ZHANG: What do you do to beat the compliance requirement to get your incentives today? What are the measures you're thinking of that we squeeze you out in a sense?
MS. BROOKE: Time out. We've got about two minutes more for this one, we gotta keep going. So let's keep going. So I don't know if we can get into every detail that you want to discuss, George.
MR. NESBITT: Right.
MS. BROOKE: Maybe we can get some of this offline.
MR. ZHANG: Okay.
MR. NESBITT: Yeah. It's just – you can have 2 x 6 walls, you can have 0.3 solar heat gain coefficient windows, you know. And you're still not there. You could have a central boiler, you could have a, you know, high efficiency, you can – you know, getting to 15 percent is sometimes actually impossible without -
MR. ZHANG: But, George, let me just show you, just summarize it. And I say let's go back to this table again. Those are the solar fractions in the prescriptive package. You add another 15 percent, you beat it. Instead of using 20 percent solar fraction, if you want to use 35 percent.

Not only that, if you're going to install solar you still have the option of doing your high efficiency boiler and high efficiency furnace, they are still there. Right?

MR. NESBITT: Yeah, but on high rise multi-family you've got virtually nothing else. I mean, you can't even install your insulation correctly in high rise. I guess everyone does. In fact I don't know if we're actually assuming QII or D-rated in high rise.

MS. BROOKE: Okay, we're going to have to – you guys, I think, should keep talking and – I'm struggling to understand your issue. So if you could go back and talk with Yanda and then come and talk to us about what your issue is. Because we're burning time and you guys are having a private conversation that we're not involved in, it sounds like.

MR. NESBITT: I just think on high rise we've got a pretty darn hard bar.

MS. BROOKE: Okay, thanks, George.

MR. SHIRAKH: Thank you. Mike?+

MR. HODGSON: Mike Hodgson, ConSol. A quick clarifying question. The title of this presentation is Multi-Family Domestic Hot Water and Solar Water Heating but it only applies to the systems that have a recirculating system, is that correct?

MR. ZHANG: You are right.

MR. HODGSON: Okay, so if we have an individual tank in an apartment complex or condo then this is not pertinent?

MR. ZHANG: Yes, if your distribution of a tank and then branch out to individual units, you don't have a loop, it does not apply.

MR. HODGSON: Okay. It would be nice to have a more specific topic title.

MR. SHIRAKH: Very good point.

MR. ZHANG: I think it's specified here.

MR. SHIRAKH: Any other comments from the audience?

(No response.)

Anybody online?

(No response.)

Okay, why don't we move to the second topic, which is Residential High Efficiency Water Heater Ready Measures.

MR. ZHANG: So this topic is still related to hot water heating but it's for single family hot water heating instead of multi-family. This CASE study looked at the opportunities to make building ready for high efficiency water heaters, not requiring this installation, instead making ready. And the major reason is that we have various federal standards and California standards that are driving the market towards using high efficiency water heaters. So the specific measures we are talking about here include four components. One is the electric connection, the second is the vent system, the third is condensate disposal and the fourth is gas supply. We will talk about them in detail later.

I also want to mention that at the early stage of the CASE study we looked at the opportunities of any savings from flue dampers. We based it on the data collected, stakeholder feedback, (unintelligible) not consider them because there are technical feasibility issues. And we also look at – considered adding the water heater blanket requirements, I should say enhanced existing water heater blanket requirements. And we also realize that potential saving is relatively small so it’s not as effective as we thought. So again, just to summarize and to report to you that those are the things we studied but decided not to propose.

So the first thing we would like to bring your attention is the new federal standards, which will be effective in 2015, one year after the 2013 Title 24 standard effective dates. You can see that federal standards already began to require high efficiency water heaters. By that I mean one is condensing, another one is power vent system. So specifically for gas storage type water heaters with storage of more than 55 gallons – and you can see the energy factor will be 0.75, 0.76, which you can only meet it with condensing water heater. And for instantaneous water heaters, or tankless water heaters, the energy factor is 0.82. You know, you have to meet it with the power vent system.

Again we are saying they will already be required so we need to bring all the house ready for them. It's true that if you are using standard 50 or 40 gallon storage water heaters they are not required to be power vent. And related to that is Energy Star Programs. The new Energy Star Programs shown here, one is for storage type, one is for the tankless type. And, in fact, you can see that for the tankless it's the same as the new federal standards. So, you know, it probably will be updated soon because eventually it will be the minimum requirement, I don't think it will be the Energy Star requirement anymore. And 0.67 is the new requirement for storage type water heaters. Traditionally that probably can only be met by power vent systems but I like to point out there are technology developments that allows still the atmospheric combustion natural draft water heaters to reach this efficiency level, again without power vent.

Another really quite related requirement is the California low NOx requirement being adopted by several local air quality districts, even just six of them but they cover roughly 77 percent of California in terms of population. And in a sense, you know, it's not the whole water heater efficiency requirement but they are directly related to that. When I say that is because if you want to meet the low NOx requirement and meet the Energy Star requirements you have to have power supply. So that's also another reason, you know, we recommend that electric connection should be there because otherwise consumers in most of California are basically shut out of the Energy Star Program. You know, that's kind of unfair.

So when I put all those things together and also trying to give you perspective that we know that federal standards will be evolving. So what they would like be? Because when you buy a house obviously it lasts more than 30 years, we need to consider that time frame. So on the left side is the different levels considered by the DOE for gas storage type water heaters. On the right side is for tankless water heaters. So what's being graded out is what will be our law in the sense by the DOE standards by 2015. So those blue areas is options we have.

And I will also mark the Energy Star criteria levels, correspond to all those different levels. And I also mark the previous Energy Star levels that just trying to indicate because all of those things more or less together, you know, the previous Energy Star has been adopted by the new – is adopted as a new federal standard. So if that provides some reference you would see this will be the future direction will be. And as we talk to the industry, I talk to stakeholders, I think almost everyone believe that within 30 years the next federal standards, you know, will definitely go beyond the two level here, the standing pilot goes beyond that. Within 30 years whether it goes to condensing, it's highly possible but non one knows for the storage type. But if you look at the instantaneous water heater side. What's left is almost the standard today. So within 30 years it's highly possible they will go to condensing in terms of federal regulations. That is another rationale we think support the recommendation that we want to have house ready for high efficiency condensing water heaters.

What is currently in the market? Does it support the regulations? You know, one observation is the 2006-2008 Utility Program Evaluation done by the CPUC. What they found is that tankless water heaters, instantaneous water heaters have been, you know, adopted at a very fast pace going from under 1995 standards, zero percent, to 24 percent. That's basically 2006-2008 time frame. You already get 24 percent of new construction using tankless water heaters. This is very consistent, you know, with manufacturer's assessment and they been basically saying they projecting more than 10 percent growth rate of tankless water heaters, you know, by 2015, that tankless water heater, the minimal standard will be power banded systems. And DOE also provide some projections here based on the AHI shipment data, the industry shipment data. And Energy Star kind of goes. And what they are saying is that without the new federal standards that they will project that the market share for, for example, storage – for high efficiency at Energy Star or even beyond, will have roughly six percent of the market share by 2015. And for tankless they predicting that they will have, you know, the high efficiency tankless will have, you know, 50 plus 20 plus – basically more than 80 percent of the tankless will be high efficiency by 2015. This is without the federal standards, you know. Obviously, with the federal standard we can only see those market share going to go up.

So goes to specific measure feasibilities, measure requirements. In the first ones, electric connection, what we are recommending here is to have 120 volt electric receptacles near a water heater because all power vent system need that. Or, as I say before, even your low NOx Energy Star water heaters need that, too. You know, in most of the houses the water heater is located in the garage and electric receptacle is already there. So all we potentially say they need to be adjusted to move it closer to the water heater.

And the second one is the condensate disposal measures. And what it means is, one, you need to have a drain line. Either it goes to the side wall, goes to outside, or it goes to your building drainage. And this is being done commonly for HVAC systems so it’s not something new. It can be easily implemented. Neutralizer is needed but not as a building feature, those only needed when you actually install a condensing water heater.

Flue vent. In our initial proposal we did trying to see if is any solution for consumers such that you can install a flue damper that works for all types of water heaters. If that’s a case, you know, obviously you can save people a lot of money because they don’t have to retrofit it. You know, as we studied and hear stakeholder’s feedback we do realize that that solution is not really there. So we can't find a flue vent product that fits all. For example, normally for natural vent product you going to have Type B vent but for power vent system usually you going to have Category III or IV type vent. By the way, those categories is created by the – what is that, National Fuel Gas Association, I think. I have that in later slides. Also there is issue, I know certain condensing water heaters are tankless, especially tankless water heaters that use a proprietary vent. So, again the issue is that there is not really a kind of one solution or one product for all solutions.

In terms of the gas supply, again we see a huge amount of adoption of using tankless water heaters. So if you are going to use half-inch gas supplies in many of the homes, the result is you have to install a separate gas line potentially from the meter to your water heater and to support the water heater. Most of the time in most of the house the exact pipelines for gas that can support tankless water heater depends on your house. You know, depends on – you know, the pressure is usually set but it depends on your pipe, pipe run length, how many elbows you're going to have, basically you have to do pressure loss calculation. But in typical homes usually you going to need a three-quarter inch pipe versus half-inch pipe. So for our cost analysis we assume that you have to have a three-quarter inch pipe versus half-inch pipe to meet this requirement.

So how do we perform the cost effective analysis? This is again, you know, one of those ready measure, how do we consider that? So we can consider basically, you know, two scenarios. One, if you are going to do install high efficiency water heaters – why? Because we say that federal standards are going to require tankless to be high efficiency, right? So if you're going to do them are they cost effective? Is it cost effective to just install high efficiency water heater? And, two, for the rest of the people they do not want to install high efficiency water now, instead we require them to get the house ready, obviously that will have some additional cost, the ready cost.

So we basically consider the kind of the whole new construction population for those they do not using high efficiency water heaters. That will be the total cost to meet the ready measures. And then we also consider what the possibility of avoided cost. For assessing those two component, one is we need to know what is the existing percent of buildings they were using high efficiency water heater during new construction. And for future avoided cost calculation we look at the percentage of population that will upgrade to a high efficiency water heater. And then we compare those two to see if the avoided cost is higher than the total cost to meet the ready measure. If so, what will be that – you know, the upgrade percentage would be. And we use that to compare to the market trend to see does it make sense.

So let’s look at some of those numbers. First, those are the water heater costs based on DOE rulemaking documents. The DOE done very, very extensive studies, all different stakeholders. And we know early on we had stakeholders question the DOE status validity. And, you know, obviously when you look at the DOE rulemaking documents there is always different sides, opinions. You know, we think that DOE's final result is very well vetted with all the stakeholders. And that's why we decided to use this sets of data instead of, you know, kind of create the wheel again. We don't think we can have better assessment of cost data than DOE.

So those are the cost data again for different components for installation. I break it down into three scenarios. There is the new construction cost. What would be the cost of doing the retrofit that you decide to upgrade your water heater to a high efficiency model. And also then the replacement cost – replacement means that when you replace it you don't upgrade, you use whatever you have. Again, so three scenarios, what would be the cost. I listed here for consistency. Previously we considered using the stainless steel B-type vent but this is not used here anymore because we don't require to install that, to install stainless vent anyway. So this was used in previous discussion but it's not used anymore since we changed the proposal in a sense.

This is the cost effectiveness of different water heater options. So what you can see – maybe just go up – okay, stay here. On the top is the gas storage water heater. Condensing water heater, they are actually cost effective compared to baseline in some climate zones, not all. But on average it is cost effective. But when you look at the instantaneous water heaters all those levels beyond the new federal standards they are cost effective. This is to a certain degree not surprising. That's why we see, we talk about new construction already have 24 percent market penetration from zero. And industry also predicting more than 10 percent growth. So I think, you know, obviously there is some valid stories here that favor instantaneous water heaters.

By the way, I do like to include this comments to address the question before, is that we did consider the end effect rating discount imposed by the Title 24 ACM. So eight percent discount. So instead of using the rated value for energy savings, I used the discounted value for energy savings calculation.

So this is the cost savings. We consider what the cost for a new construction, you just get the ready versus in retrofit you have to retrofit your vent, your gas supply and all that. So the estimate basically say this is the incremental cost to get your house ready for high efficiency it roughly cost $133.00, compared to your baseline using standard water heater. Your retrofit will cost you more than a thousand dollars, $1357.00.

So using the previous equations what it lead to is that if you can – if we can expect 7.5 percent of the homes will upgrade their water heater to high efficiency in the future within thirty years it will be cost effective to do it now. So can we expect 7.5 percent adoption in 30 years? You know, given all the data we say, 10 percent growth of – more than 10 percent growth of instantaneous water heaters, right? And that's already beat this number easily. So within 30 years also talk about, you know, there is highly possible the storage tank federal standards will be at least equivalent to power vent system if not condensing. So 75 percent is a very, you know, small fraction to what would happen.

We would like to also bring up this, since we presented in the stakeholder, I think it's a very useful information. It's also consistent with a lot of the market observations why tankless water heaters are favored. Because it definitely provide a lot of savings opportunities that using the existing 2008 ACM, you can see by using those different high efficiency options you can improve your (unintelligible) energy consumption TDV a lot, by a big margin, 25 percent. And that basically translates to, you know, five or 20 or 30 percent of your whole performance budget, energy budget. So the cost is only roughly $300. So in a sense if you want to beat the code by 15 percent it's not that – well, I shouldn't say that easily, but I mean just saying here is the option that you can beat by 20 percent without that much cost, only $300. So options are there.

So this is to summarize the code language. And we basically saying system using gas and propane water heaters to serve individual dwelling units. So it does not apply to multi-family central systems. They should include those components, 120 volt electric receptacles within three feet from the water heater, and Category III or IV vents, condensate drain meet local jurisdiction requirements - because, you know, can have potentially different requirements locally - and gas supply line with capacity of at least 200,000 BTU.

And, you know, exception to the vent requirement, you don’t have to do it, is that we want that you do install or have a system that can be virtually easily retrofitted. That means that if you don’t install high efficiency water heater along with the vent system we want you to specify in your plan that they can be installed easily. The plan should show a vent path less than 12 feet without any interior walls along the path and a side wall vent location in compliance with the National Fuel Gas Code. So where is the 12 feet come from? And this is after we look at the PIER research single family DHW systems, six typical home designs, floor plans, and 12 feet is the average. Obviously, it varies from house to house. Many times, for example, my house water heater is located right next to the side wall. It would be, you know, easy to in compliance. But if you going to have your water heater located differently that's potential defect.

I do want to bring this up. As we been discuss with the industry quite intensively, especially after the last stakeholder meetings and (unintelligible) and brought up a good comments and also provide this proposal. And basically saying, you know, my understanding he say other things make sense. But he suggest the B, component of B and exception to B rewriting different way. Which seems to us is more or less the same thing.

This is the end of my presentation. Thanks.

MR. SHIRAKH: Mike?

MR. GABEL: Mike Gabel, Gabel Associates. So is it my understanding then that as a mandatory measure this would be triggered for alterations, if someone replaces their water heater then they have to meet this requirement?

MR. ZHANG: It was not our intent.

MR. SHIRAKH: No.

MR. ZHANG: I don't think the code is written in that way either.

MR. SHIRAKH: Well, I mean, this is going to go into new construction. I think it will be in Section, what is it 150?

MR. ZHANG: 150.

MR. SHIRAKH: 150.

MR. GABEL: But –

MR. SHIRAKH: And 152 we have to clarify that this does not apply to existing.

MR. GABEL: Okay, so this is not a mandatory measure then?

MR. SHIRAKH: It is a mandatory measure but –

MR. GABEL: But only applied to new construction?

MR. SHIRAKH: New construction.

MR. GABEL: Okay. I just want to make sure that's clear. Thanks.

MR. SHIRAKH: Mike?

MR. HODGSON: I would like to go to the market analysis on your comment on that there were no water heaters in 1995 in that slide. And then 24 percent market penetration under 2005. Was that people who participated in the new construction programs or was that of the market?

MR. ZHANG: It is the market. The CPUC evaluation look at the Codes and Standards Program and the new construction program altogether. So it's evaluated as a whole.

MR. HODGSON: Okay.

MR. ZHANG: So it does not separate them out.

MR. HODGSON: Well, then I think that number is very suspicious. Because it's a very high number. I'm a very strong proponent of tankless water heaters, we try to convince all of our clients to do that. But I just texted the office and said, What’s our market share of tankless water heaters in 2011? And it’s less than five percent. It was higher two years ago, three years ago, when the market was a little more robust. Because now we are cutting costs. But I think you have an optimistic view and I don’t think it really affects too much of your analysis but I really don’t think there is a quarter of the market using tankless now or in the near future.

And you could verify that by going to, you know, CalCERTS and going through the HERS requirements and asking. Because the Energy Commission could do a data request. I just think – I’m not objecting to the analysis, I just think that is quite optimistic. If it’s 24 percent of the new construction programs, which are those who are building above code already, I think I could accept that number. But then that’s probably - their market share is probably ten percent of the market, so now we’re down to a 2.5 percent market share. And I think it’s higher than that. So I think it’s in between those two numbers, but I think 24 is much to optimistic.

MR. ZHANG: I don’t have a personal sense of it. When I first read it I surprised too. But to me seems this is the latest data I can have. And obviously when I look at it I say, Oh, wow, and had that same feeling. And when I've talked to people, you know, the industry. For example, A.O. Smith, that's what their data, you know, their industry studies. That's what the suggestion is, that tankless, they are basically saying it's 10 percent growth year by year. That's what they seeing go on forward. It kind of feels –

MR. HODGSON: And I can understand a ten percent growth –

MR. ZHANG: - to me there is some consistency.

MR. HODGSON: - because it all is relative to where you're growing from.

MS. BROOKE: Right.

MR. HODGSON: That I don't have an objection to. I just think the perception that the market is already a quarter percent tankless and that it itself is growing 10 percent a year needs to be kind of dug into a little deeper. The Energy Commission has resources to do that because you can screen the HERS providers and ask them, you know, what has it been the last couple of years and you could get very accurate data.

MR. SHIRAKH: Thanks. And I guess I don't know if – I mean, I understand your point and you guys have a lot of experience with this. But I think another point that he was trying to make in 2015 there may be this change in federal standards which may drive the market towards –

MR. HODGSON: Yeah, the ugliest appliance in the house right now is the water heater.

MR. SHIRAKH: Yeah.

MR. HODGSON: So, I mean, federal standards move very slowly and I think the concept of getting a power vent in there is very intriguing. There is some cost data that we need to look at. But if we're going there anywhere in 2015 is that a difficult thing to do? Having it as an option on the plans sounds good, but no one plan checks this stuff anyway. So, you know, we should talk about what you want to have in the field as opposed to what you want to have in the plans.

MR. SHIRAKH: Okay, thank you, Mike. Any other questions?

MR. NESBITT: George Nesbitt. Can you go back to the code language? The change in the start making the supply to all gas water heaters is definitely the right direction. So on the electric connection you have within three feet. You probably also want to add language that it be within the hot and the cold supply tap and ideally above six feet. Because if you put in a tank you don't want that outlet to be behind the tank because you won't be able to plug it in or out and you can't usually move a tank. Obviously, if you have a tankless and it's mounted lower that can potentially be a little problem there if it's on the outside. But we don’t want to put an outlet where it won’t be useful. As someone who installs these things, it’s tough. You can tell someone to do something and they put it in the wrong place.

On the condensate line, some difficulties. Although not all high efficiency water heaters are condensing, it’s certain ultimately a way to go. Pretty much everything I do is. One of the difficulties is you don’t always have a gravity drain so you’re into a pump situation. The A.O. Smith Vortex, which I’ve installed several of, the condensate connection on the water heater is literally within an inch of the floor, which is difficult.

MR. ZHANG: Yeah.

MR. NESBITT: I actually spent, I think, about eight hours on a job last year running a condensate line under decks, under crawl space, and then another eight hours running my TNP. Unfortunately, we had to move the water heater from right next to the outside wall.

MR. ZHANG: It tells you how much you appreciate the ready measure would be, right?

MR. NESBITT: Yeah. Well, there’s being ready and then it’s being useful when you need it.

The gas line, okay, good. You have a gas line.

MS. BROOKE: So, George, I missed what you – what were you intending for a recommendation for the condensate line?

MR. NESBITT: No, I think having it there, absolutely. It comes down to location. I mean, obviously you don’t want to put it right under the hot and cold if someone puts in a tank, that would – you know, it needs to be to the side –

MR. ZHANG: Right.

MR. NESBITT: - but there are –

MR. ZHANG: But you prefer it’s gravity-based drain, right.

MR. NESBITT: Yeah, we would prefer it, obviously. It’s not always possible.

MR. ZHANG: If the water heater is too low and the drain is at the very bottom then your condensate cannot have a gravity drain to somewhere else. So then you have to hook up a condensate pump. It’s something you would like to avoid.

MR. NESBITT: Yes. I mean, having a pipe, what we don’t want is people to throw it three feet high on a wall where then you’re going to be forced to pump it, perhaps.

MR. ZHANG: Right.

MR. NESBITT: Or go through greater effort. So perhaps –

MR. ZHANG: Are you suggesting –

MR. NESBITT: - we do need to add the condensate –

MR. ZHANG: - the condensate drain line to be more specific? Like be able to not sump well, like five feet away probably makes sense.

MR. NESBITT: Perhaps we have to say it has to be at ground level. You know, I mean we're not always going to avoid having to go to a pump.

MR. ZHANG: Some location then.

MR. NESBITT: Yeah. I see on the gas line we've just gone to the simple wording of having the capacity to provide 200,000 BTUs, which is great. Because obviously if you go stainless steel flex you will probably need the one inch.

Mike asked about alterations. And that's a section that needs really actually a lot of work and clarity for when the code actually applies in alterations and what we do and don't.

MR. ZHANG: You know, we said it does not apply to alterations?

MR. NESBITT: Right.

MR. SHIRAKH: We say that but, you know, there are some cases where this may apply. So we will think about that. But for simple retrofits, I don't see why this should apply because –

MR. NESBITT: Right, if you're doing a water heater change-out, probably not.

MR. SHIRAKH: Yeah.

MR. NESBITT: And that’s somewhere I don’t know if in the code where we define at what point you literally have to comply as a new building.

MR. SHIRAKH: Well, that’s – solar-ready we have to think about that and this is kind of along the same lines, you know. We will think of something. I don’t have it in my mind now.

MR. NESBITT: What if I put in an electric water heater? Now, in order to do it to code I may or may not have to do solar hot water depending on whether I’m prescriptive or performance. If the house is served by gas would we want them to have the capability of having a condensate drain, electric power – although if they have an electric water heater they’re going to have 220 volts. But would we want them to have the ability to go to gas, is a question worth asking.

The last is the vent flue and we beat this around a lot. I think the difficulty is there’s too many technologies we can use. There is no – it’s not like high efficiency gas furnaces where everything is plastic pipe. I can't think of one gas condensing furnace that isn’t. So obviously we can't specify what kind of vent you would put in for the future. Whether or not 12 feet horizontal, difficulty. A lot of newer developments have virtually no lot line so no setback. So if our 12 feet is to a setback that would not allow us to vent horizontally. We are going to then have to run vertically also. So the problem with the vent is I think specifying anything, although it's certainly an ideal that a water heater is located on an outside wall and that it should have adequate clearance to go horizontal or to be able to go vertically up the outside. Perhaps difficult in practice.

MR. ZHANG: So related to that I think, yes, these are good comments. But I think we do need to consider that because the federal rulemaking, when they consider this they did not say, Oh, because you have homes out there, you know, you have to have them retrofit so I don't consider go through the next level, right? You know, they basically look at on average what is cost effective. Once they force us to go to a power vent all of us have to retrofit. All those problems you're saying, if we don't do it correctly people is going to suffer.

MR. NESBITT: I mean, most of the time retrofitting, especially with plastic venting, is easy. If we talk about stainless steel and tankless that gets extremely expensive. And even B vent ends up – is actually not cheap, especially as you get into longer horizontal runs and longer vertical runs. But, I mean, overall we definitely – planning for the future is good and it's something I do, whether it's pre-plumbing for solar, electric, PV, you know, trying to future-proof. The difficulty is predicting future. And I would say this is – from where this was last week this is vastly improved and I think just a few minor little tweaks in the vent issue is really, I think, the biggest problem.

MS. BROOKE: Thanks, George.

MR. ZHANG: Thank you, George.

MR. SHIRAKH: Bob?

MR. RAYMER: Bob Raymer of CBIA. With regards to the condensate drain, I agree with the statement. And, of course, the builder and the site superintendent are going to make sure that they meet the local requirements. It’s just that at the local level these requirements are more like policy guidelines, they’re not formal local requirements, you know, adopted building standards modifications, state code. They are guidelines. And they pretty much word of mouth as opposed to written down and established. So that’s kind of how that works.

I agree with your statement, you need to make sure that you comply with what the local jurisdiction has in terms of their goals or whatever. If you don’t, you can run into slowdowns in the project, but it’s not a formal issue in most cases. You effectively ask Rick Renfro in Elk Grove what are the requirements for Elk Grove and he’ll tell you. And you’ve got to have a little receiving pit down on the – if you’ve got a backyard patio, it can't just fall right onto the concrete. That’s their requirement, but it’s not written down anywhere, Rick knows it. So I guess you could put down, Ask Rick if you are in Elk Grove.

The other thing, if we could go back a page, the upper statement. I’m sure there’s an explanation for this but 80 percent? Could you explain?

MR. ZHANG: If you go to the coastal climate zones there is no heating.

MR. RAYMER: Oh, got you. I’m sorry, I understand.

MR. ZHANG: Okay, yeah.

MR. SHIRAKH: Thank you, Bob. Any other questions from the audience?

(No response.)

Anybody online?

MR. WARE: Yes, we have a few questions. The first one was sent by Frank Stananick (ph). He has an explanation for an alternate proposal. The key point is that the requirement for Category III or IV vent system is impractical for atmospheric natural draft models. Those models will always use the exception. Additionally, if the installed model uses a Category III or IV vent you do not need the requirement as a vent system will be required by the model safety certification. Therefore, it is better regulation writing to just specify what is now proposed as an exception.

MS. BROOKE: So let me see if I understand that. He wants us to put the exception in as the code and –

MR. ZHANG: Is already proposed here. This is his proposal.

MS. BROOKE: This is his proposal?

MR. ZHANG: Yes, AHRI proposal. It is not using the exception, just write that into the –

MS. BROOKE: Okay, no specification of a vent type?

MR. ZHANG: Yes, right. Just to specify the vent pass if you are going to use the natural vent system.

MS. BROOKE: I see, I see, I see.

MR. SHIRAKH: And what's your reaction to that?

MR. ZHANG: I say that from a compliance point of view it's the same. I don't think it cause any conflict.

MR. SHIRAKH: Okay, we will consider that. That sounds like a good comment. Any other comments?

MR. WARE: Yes, there is one more.

MR. SHIRAKH: Are they online? You can speak, if you wish.

MR. WARE: Jim, are you there?

MR. LUTZ: I can hear you, I don't know, can you hear me?

MR. SHIRAKH: We can hear you.

MS. BROOKE: Hi, Jim.

MR. LUTZ: Hi, Martha. The comment on the electric water heater –

MR. SHIRAKH: And could you give us your first name, last name and affiliation, please?

MR. LUTZ: Jim Lutz, Lawrence Berkeley National Lab. On the comment for the electric water heater, if you put in an electric water heater if it's a heat pump water heater you will need a condensate drain as well. So I would like to see the condensate drain in there. That's my only comment.

MS. BROOKE: Okay, thank you.

MR. SHIRAKH: Any other comments on this?

(No response.)

Okay, we're going to move to our last topic of the day, which was actually previously presented, I think, about two weeks ago and we had some comments on it. So we basically are re-presenting it based on, you know, modifications we did to the proposal. Marc Hoeschele is going to do that. And we combined it with another proposal that had to do with the showerheads so we made it into one proposal.

MR. HOESCHELE: Hello, I'm Marc Hoeschele and this proposal here was – at least there are two proposals that have been put together because they are both related to water heating and water heating energy use. And the single family water heating distribution system enhancements proposal was first presented at the May 24th workshop. And I will be covering that. Owen Howlett of Heschong Mahone will be presenting on the showerhead CASE study which will follow right after this.

What I’m planning to do is not to cover all the details from the original proposal but present the new information. At the May 24th workshop there was some concerns about the concept of the compact hot water distribution system approach so we’ve kind of modified that to provide more flexibility in meeting that measure. So the proposals identified and presented previously related to single family distribution systems - and this specifically is to non-recirculating systems - is that all three-quarter inch and larger piping will not be required to be insulated, limiting the amount of one inch pipe in homes to a maximum 10 foot total length – and there is an exception to that – and then as a prescriptive requirement making compact hot water distribution systems the standard but now we’ve allowed for a water heater efficiency trade-off as an offramp to that. There are also proposals on ACM modifications to better align the predicted energy use with the residential appliance saturation survey and additional evaluations related to how different distribution system types, or DSMs, distribution system measures, are represented within the ACM.

Bob?

MR. RAYMER: Can you go back to the previous slide, please? Yes, Bob Raymer with CBIA. I would like to reiterate the concerns that we raised at the previous meeting and echo those that were made by CALBO regarding the first three bullets, particularly bullets number two and three. It would be our strong recommendation that the Energy Commission consider at least bullets number two and three as compliance credit for 2014 and then indicate clearly that it's going to become a requirement of the regulations in 2017. I think we heard compelling testimony at the last meeting that in terms of field application of this prescriptive measure we're not going to get there in 2014; that in particular the assumption of the compact water distribution system, we're simply not going to see enough education and training with the contractors, the plumbers, the site superintendents, local enforcement, plan checkers and we're not going to see communication between the energy consultant, the site superintendent and the plumbers to be able to actually have any chance of implementing this in a quality fashion in 2014.

I understand that there are energy saving benefits from this. But the field application of this, we're going to be trying to do way too much that hasn't been done in the past in too short of a time. And, as Tom Garcia from CALBO indicated at the last meeting, we are setting ourselves up for failure. I think you're going to find a lot of energy consultants will use this at the front end of their calculation. That information is not going to get adequately transferred to the subcontractors and you're not going to see this actually applied and we're going to have red tags or non-compliance.

MS. BROOKE: So we heard your concerns and Tom's concerns and we tried to address them with what Mark is going to present next. And so –

MR. RAYMER: The offramp?

MS. BROOKE: No, our redo of the compact design proposal.

MR. RAYMER: Okay.

MS. BROOKE: And so come back up at the end of that.

MR. RAYMER: I'm sorry.

MS. BROOKE: No, that's okay. Thanks, Bob.

MR. SHIRAKH: The compact design, if I understand Tom's concern, was because, you know, he thought you could not plan-check this because it was based on the actual length of the pipe. So we changed that requirement. Why don't you hear that and then let us know of specific concerns.

MR. RAYMER: Okay.

MR. HOESCHELE: Yes, so I will get into those details. So, we've done a lot of field work looking at plumbing installations, piping installations prior to drywall and taking detailed measurements on what gets installed in terms of length and diameter and where the piping is installed. And this graph basically shows data from about, I think, 75 homes. And it's the average volume between the water heater and each of the fixtures in the house. So there is a lot of clustering of data around one gallon, which suggests that for any fixture in the house, or the average fixture in the house, it would be one gallon of water between the water heater and that fixture. And then we show recirculation systems here also, which have much higher volumes. They do result in much less water waste but we have to be concerned about how much energy is contained in the recirculation loop in terms of hot water.

The key point to take from this is how much variation there is vertically at any one given floor area. If you look at 2000 feet you will see a wide spread between the best performing house at about half a gallon average volume to the worst performing at 1.5. So there is a lot of variability in the field. This data is looking at how common one inch piping is and the length of one inch piping is on the left-hand axis. On the right-hand axis is the floor area of the house. And there are 110 data points shown here. Seventy of the 110 have less than 10 feet of one inch piping, so that’s almost two-thirds. More common, but not exclusively floor area-dependent, you see, you know, houses with more than 10 feet. Actually, the worst one here is a small 1200 square foot house that had almost 50 feet of one inch piping. But, again, this data is all over the map. So the goal here now, you know, is to focus on the worst performers with the second mandatory measure related to limiting the distance to 10 feet.

So again the field findings overall, you know, working with PEX has a lot of performance advantages, it has less volume per foot than copper, it’s cheaper and easier to install, no soldering required and so forth. But what we seem to be finding in the field more often than not is that there are a lot of sloppy installations which have too much volume and too much pipe length. So we are trying to address the length of the piping, the diameter, and then require insulating piping where it’s cost effective.

The tool used to evaluate the different cases, and there are six prototype floor plans that we worked with that were developed through a prior PIER project, the program is HWSIM that was developed through funding from DOE’s Building America Program as well as the California Energy Commission. And this just shows the detail that the model has. On the left this is an input screen or actually two input screens from the program. On the left-hand side is how you actually lay out the piping in any given house and each pipe element shown on that plumbing tree there would have a unique length, pipe diameter, environment that it may be located in, whether it’s between floors or attic or garage, and pipe material and the presence of insulation. So all those can be modeled within the program.

On the right-hand side is displaying what one particular draw, how it can be characterized. So this defines where the hot water is being drawn, what time of day it’s being drawn and, you know, the volume of water to be consumed, the minimum temperature and whether or not the use type, such as for a shower where the person is going to wait to insure that that minimum temperature has arrived at the fixture. So the model tracks the flow of water through the full plumbing tree to get the thermal impacts and the water implications of water waste and so forth.

So from the May 24th workshop there are details there, I haven’t provided them all here. But I’ve provided benefit-cost ratios for the three cases we’re looking at. Insulated piping greater than or equal to 3/4 inches was a benefit-cost ratio of 1.53. Limiting one-inch piping to 10 feet, as we saw on the prior graph it’s not that common but when it does exist it’s a highly cost effective thing to do from an energy savings versus cost impact. And then the third item, the compact hot water distribution system, which is focused on locating the water heater more centrally relative to hot water use points, it also benefits from the architect looking at how the house is laid out. I mean, you look at many floor plans and you can see opportunities for flip-flopping master closet and a master bathroom that would bring those use points 15 feet closer to the water heater, reducing the volume. And then addressing the actual plumbing layout, which is kind of the longer term goal for education and training for the plumbing industry to install these systems more efficiently.

So again the proposed requirements, as discussed, greater than or equal to 3/4 inch piping, all would be required to be insulated, limiting in non-recirculating systems one inch pipe length to 10 feet total pipe length, and then a compact hot water distribution system approach with a water efficiency tradeoff as an offramp.

This was the proposal at the May 24th workshop. The data points show the maximum run lengths from water heater to fixture from a group of houses that we surveyed and the red line was the proposed maximum length, which would require field verification. And, you know, at that workshop, as Bob pointed out, there was concern over the feasibility of this. So we’ve reworked that now. And what we’re proposing after reviewing a set of plans, a set of 15 plans or so, we are proposing a two-stage approach where there is a plan check, a maximum length from a plan check process. And that’s just a direct plan measurement from water heater to fixture. And this is shown in the orange line. And then there would be a field verification consistent with the prior recommendation. So this would – and the plan check process would provide a good indication of whether or not you can achieve it in the field. It’s not a hundred percent guarantee because there are always anomalies that are encountered. But it gives you a good sense of whether you can achieve it or not.

So the offramp that we are providing now, instead of the – we would still set the prescriptive requirement at the performance level of a compact how water distribution system and we’re projecting that’s in the 8-12 therms per year savings range after looking at the other two measures as mandatory requirements. So incremental to the pipe insulation and 10 foot maximum pipe length, we’re looking at making up 8-12 therms per year. And when we look at the ACM, how the ACM handles water heater efficiency, for a typical sized house you’re looking at a 0.02 to 0.04 increase in the energy factor of the water heater to offset that. So this would be the tradeoff that you could pursue in lieu of the compact hot water distribution system.

And Yanda presented some of this data. But looking at efficiency levels, the different categories of water heaters currently on the market, you know, gives you an indication of where the performance breaks are and current Title 24 – well, as I will show here. This slide basically provides three cases for what you would need to get this 0.02 to 0.04 change in energy factor. The blue symbols on the top show the current ACM modeling of the impact of putting in a higher than standard efficiency water heater as a function of energy factor. And this is for a 1761 square foot house, so this is going to vary with floor area in a small way. But one of the proposals that we have on the table, presented at the May 24th workshop, was to bring the budget into alignment, the ACM projected budget better in alignment with RASS. So the red dots reflect approximately where that will stand after that alignment is in place. And then the green dots are looking at once the 2015 federal requirements for improved efficiency come into play, you know, what the impact will be.

So basically the impact under the estimated 2013 ACM, we’re looking at about a 0.02 increase plus or minus to offset the compact hot water distribution system impact. As we move to the post-2015 environment we’re looking at more of a 0.04 range. If you look at the tankless as an example they are shown at 0.82. And, you know, you can see there the impact is much bigger. So pursuing that avenue or other higher efficiency water heating strategies will get you a bigger impact than the compact strategy.

So the code change proposals, mandatory requirements for pipe insulation above 3/4 inch, limiting one inch pipe length to 10 feet. And the one exception we would provide for any large tubs that have high flow requirements, they would be eligible for a dedicated line that could exceed 10 feet in length. But we would want that line to be dedicated to that tub. Appendix E, the ACM – you know, we talked about some upgrades to that, adjusting water heater set points to bring the budgets in alignment and new distribution system multipliers. And the prescriptive requirement for the compact hot water distribution system would be reflected with the language shown here and adding a plan view measurement as the first step in the process as part of the plan check process and then a HERS field inspection for the final pipe measurement verification. But, again, the tradeoff to this would be through the performance path, would be putting in the higher efficiency water heater as a tradeoff.

So I think I will take questions now before we transition to Owen’s presentation on the showerheads.

MR. RAYMER: Okay, I’m reading this for the first time. I don’t understand it. It may be good, I don’t know.

MR. SHIRAKH: So if I can explain –

MR. RAYMER: The first comment, though, is are we assuming that there are detailed plumbing plans that go through plan check and then are inspected out in the field? Is that kind of a general assumption that’s kind of being made here?

MR. HOESCHELE: No. I mean, the plan check process is just a direct measurement off the plan, it’s a very simple –

MR. RAYMER: Okay.

MR. HOESCHELE: And so that’s just kind of a guideline to the Title 24 consultant, should I be pursuing this strategy?

MR. RAYMER: Okay.

MR. HOESCHELE: You know, so some – I mean, you make a good point, some people won’t be prepared for this –

MR. RAYMER: Right.

MR. HOESCHELE: - but some people are. And so, you know, we want to encourage that.

MR. SHIRAKH: Again, the difference between this and the previous proposal was that in the previous one it was the actual length of the pipe from the water heater.

MR. RAYMER: Right.

MR. SHIRAKH: Here it is just a simple plan view distance between the fixture and the water heater on the plan.

MR. RAYMER: Straight shot?

MR. SHIRAKH: Straight shot.

MR. HOESCHELE: Straight shot. So that’s the plan view check. But, Mazi, we will still have –

MR. RAYMER: And you’re making that in plan check, okay.

MR. HOESCHELE: We will still have the field verification piece. So, you know, that’s why the –

MR. RAYMER: So you would have a HERS inspector taking a look –

MR. HOESCHELE: Right.

MR. RAYMER: - if you want to go that route?

MR. HOESCHELE: Exactly.

MR. RAYMER: Okay.

MR. SHIRAKH: Which is a little bit different than what I was expecting, actually. You know, we thought one of the options was to make the HERS verification a compliance option.

MR. RAYMER: Oh, please.

MR. SHIRAKH: And this ended up in the prescriptive and this is a little bit different than what I had expected.

MR. HOESCHELE: Okay, well we can, you know, work through that detail. I mean, my thinking is still when you review the plans and the take-offs, I mean, the plan view isn’t a guarantee that you will meet the requirement in the field.

MR. RAYMER: We would really like to see HERS inspection of this as a compliance option because, number one, we're running out of options. I mean, that's the one thing that seems to be pounded into everyone of these what used to be options are now three-fourths of them are moving to the left and they're becoming prescriptive or mandatory. I understand the reasoning there, but the ability to now say, Okay, yeah, it's in the prescriptive method but you don't have to comply. Well, you better comply because there's not a whole lot to grab onto anywhere.

MR. SHIRAKH: Yes, I understand that. I think we do. So any other questions on this topic?

MR. ENSLOW: Tom Enslow on behalf of the California State Pipe Trades. I just wanted to let you guys know that we've asked our attorney-directors and some of our members to take a look at these provisions and let you know if we have any comments. I haven't got them back yet but if they do come up with anything we feel we should share, we will let you know as soon as possible.

You know, on a macro level I think we did hear some concerns of people about the timeline of it and shared some of CBIA's thoughts about making it a compliance option. You know, the Pipe Trades has long supported energy efficiency and water efficiency standards and moving in that direction and they continue to support that but they also recognize we need to make sure that people will actually put this stuff in and the contractors are prepared to do this. You know, they're moving in that direction. UA is improving their green plumbing training for all of their members and their contractors. And I think people will be ready for this. I don't know if they would be ready for it, you know, at the timeline that you guys initially suggested.

MR. SHIRAKH: I mean, the timeline we're talking about is about three years from now. Is that not enough time for people to – I mean, all they have to do is basically do their plan check, plan view measurements, insulate – yes?

MR. RAYMER: Bob Raymer with CBIA. For those of us in the room – and there's very few, there's a lot of empty seats today – we're beginning to understand what's being proposed here. And, as I mentioned at the last meeting, a lot more knowledge is going to start being disseminated once we get to the March/April of 2012 when there is an adoption of this. Then of course it goes to the Building Standards Commission. And it will probably be formally adopted sometime between March of 2012 and January of 2013.

MR. SHIRAKH: Right.

MR. RAYMER: It may well be adopted, you know, for implementation with all the other codes. But it may be adopted at one of the business meetings prior to where all the building and fire and mechanic and plumbing codes get adopted. You know, that is somewhat irrelevant. The problem here is, it’s going to get published on July –

MR. SHIRAKH: 2013.

MR. RAYMER: - of 2013. Right now you’ve got more than 80 percent of the employees in the building industry – residential, let’s just look at residential right now. Over 80 percent of the employees are in the wind. They are not working right now, they’re gone, maybe their selling shoes, cars, anything they can get jobs on right now. They are not involved in the industry. They may be doing some retrofit stuff. They are certainly not following this proceeding. And so I am – and part of the thing that we will be trying to do is keep those people who are still in the industry up to speed on this.

But you’ve got to understand that as the economy slowly comes out of this thing you’re going to have a whole lot of people wanting to get back into industry who are going to come to the party with knowledge that may be five to six years old. They’re going to be very knowledgeable in the 2005 standards. And that is not a good thing. And that’s why we keep – you know, CALBO and CBIA have kept pounding away at this. We need long-term enduring training, not just a really good one year plan. We need every year. And understandably you are going to be changing these regulations every three years, we get that. It's just that a big problem that we now have is that you've got effectively new people that are going to be coming back into the industry that aren't going to know diddly about this. And that's a big problem. And so I figure we've got probably six months, not three years.

MR. SHIRAKH: George then Mike.

MR. NESBITT: So previously this was a mandatory measure, correct?

MR. HOESCHELE: The compact?

MR. NESBITT: Yes.

MR. HOESCHELE: No, it was a prescriptive requirement.

MR. NESBITT: Okay. Two weeks –

MR. SHIRAKH: They are both prescriptive.

MR. NESBITT: - is a long time and last night was too short. So this is the package requirement. You comply prescriptively, you have to do compact design and it's HERS-verified?

MR. HOESCHELE: For setting the performance budget. But you're saying the package requirement?

MR. NESBITT: Is this a Package D requirement?

MR. SHIRAKH: Yes.

MR. NESBITT: Or A maybe in the future. Okay. Which means this is then, you can trade this off in the performance method, you can choose to do bad design and not have a HERS verification, okay. Obviously, we HERS raters are hurting, too, and would like more work.

MR. RAYMER: We share your pain.

MR. NESBITT: I know, we do. So as Mike from ConSol said, I mean, the water heater is the ugly appliance and the distribution system is its ugly cousin. So it is a mess out there and it is definitely a place we have to address. And I guess for the purpose of the length verification, that would be lineal feet of pipe, excluding the equivalent lengths of fittings?

MR. HOESCHELE: Correct.

MR. NESBITT: Okay. And would it have to meet – then it has to be within the maximum radius as well as the maximum linear feet of pipe?

MR. HOESCHELE: Maximum radius meaning the one inch?

MR. NESBITT: No, the plan view.

MR. HOESCHELE: It would have to satisfy both, correct.

MR. NESBITT: Okay. All right.

MR. HODGSON: Mike Hodgson, ConSol. Marc, just some quick clarifications. The previous slide, which is 150 which is mandatory. Just so I got it, the one inch pipe is still maximum 10 feet, no change there, correct, from two weeks ago?

MR. HOESCHELE: Yes.

MR. SHIRAKH: What is the concern related to the one inch pipe, can you reiterate that?

MR. HODGSON: I'm concerned whether or not the manifold systems are within ten feet. Marc's data shows they are, I'm not arguing with that I'm just concerned about it and I think we need to explore it.

MR. SHIRAKH: Can you look into that and tell us, you know, whether it's 10, 12, I don't know.

MR. HODGSON: Yes, we will. Just looking at water heaters, doors, where the manifold system is in the garage wall. We're guessing it's 12 to 15 feet, but we don't have the field data that Marc has. I'm not arguing, just that's a concern, we need to verify it and we will get back to you by the deadline.

MR. SHIRAKH: Can you do that? Thank you.

MR. HODGSON: The 3/4 inch pipe insulation requirement, that's hot and cold, correct?

MR. SHIRAKH: No.

MR. HOESCHELE: Hot only.

MR. HODGSON: Pardon?

MR. HOESCHELE: Hot only.

MR. HODGSON: Okay.

MR. SHIRAKH: I think we need to make that clarification, that confused me, too. You know, we say all pipes.

MR. HOESCHELE: Okay.

MR. HODGSON: It's all pipe and I'm just –

MR. SHIRAKH: It should say all hot water pipes.

MR. HODGSON: - trying to, this is code language. And I think we probably need the code police to kind of go through this and take a look at it.

MR. SHIRAKH: Yes.

MR. HODGSON: Okay, so back to 151, I think George clarified most of my questions. This is what's going into Package D aka Package A, right? So this sets up the performance budget. So there is going to be a view and plan check of, 2000 square feet has to be less than 26 linear feet. And then there is going to be a requirement if you do nothing to have a HERS inspector to check to make sure there is 52 feet or less of maximum pipe, correct?

MR. HOESCHELE: Correct.

MR. HODGSON: So if this goes through then there is an automatic HERS requirement unless the builder opts out?

MS. BROOKE: So, yeah, a couple of clarifying things. One is that we talked about having an exception in the prescriptive standard for high efficiency water heater. So you wouldn't have to do the performance approach if you just wanted to do a tradeoff with the high efficiency water heater, is that correct?

MR. HOESCHELE: Correct.

MR. SHIRAKH: Well, that's the offer.

MR. HODGSON: In the package that you may propose.

MS. BROOKE: Yes, in the package so you don't have to go to performance.

MR. HODGSON: Okay, cool.

MS. BROOKE: And then what Mazi and I are whispering about is, you know, concurrence that we can make the HERS verification a compliance option.

MR. HODGSON: Okay, thanks.

MR. SHIRAKH: Bob, did you have a comment?

(Mr. Raymer responds that he did not.)

Okay, Owen?

MR. HOWLETT: Owen Howlett from HMG. Maybe my memory is not serving but I thought that we had discussed that HMG had a requirement in our language that was going to limit pipe diameter to half an inch and we dropped that because I thought you were going to limit the 3/4 inch pipe to 10 feet.

MR. SHIRAKH: No, that was not –

MR. HOWLETT: Not just the one inch pipe.

MR. SHIRAKH: I think what we said was we were going to require insulating 3/4 inch pipes that are hot water.

MR. HOWLETT: Okay, so there's a hard cap on the length of a one inch pipe but just insulation –

MR. SHIRAKH: There is on one inch pipe –

MR. HOWLETT: - on the 3/4.

MR. SHIRAKH: - but there is no limit on half-inch or 3/4 inch. But the 3/4 inch and above must be insulated, those are the requirements.

MR. HOWLETT: Okay.

MR. SHIRAKH: Any other questions?

(No response.)

Again Mike Hodgson would appreciate, you know, if you look into that 10 feet one inch number and get back to us. I think Martha and I agree that the HERS verification should be a compliance option.

MR. HODGSON: Sorry, Mazi. Marc, real quick, just I'm reading this chart correctly – and I'm looking at the one that you did kind of the market survey, it had all the blue dots on the bottom line – I'm presuming that chart is showing us that there is no one inch in that system in those homes, correct?

MR. HOESCHELE: Correct, at the zero level.

MR. HODGSON: Okay, so we're assuming whatever that system was, was 3/4 or less in the house, right?

MR. HOESCHELE: Right.

MR. HODGSON: Okay, thanks.

MR. SHIRAKH: Any other questions in the audience here on this topic?

(No response.)

What about online?

MR. WARE: A question from Jim Lutz from WebEx: Was the value of water considered in this analysis? Higher water heating efficiency doesn't save water to compensate for not doing a compact HWDS.

MR. HOESCHELE: We have the ability. I mean, the program calculates the water use and waste impacts. But there is no real way to value it. Martha, do you have anything to add there?

MS. BROOKE: Well, I guess one thing we could think about is if we want to bump up that delta energy factor number to make up for water loss, right?

MR. HOESCHELE: To ascribe embedded energy for water?

MS. BROOKE: Yes. So that's something that we can think about and see. If it doesn't create an unreasonable delta for the energy factor then – let's look at it and see. I mean, that would be a real appropriate thing to do. Mazi said in his summary slide this morning that we were going to consider water efficiency.

MR. SHIRAKH: I mean, we are considering it. The whole thing is about limiting the pipe sizes and all that.

MS. BROOKE: I know but what I'm saying is that the tradeoff is just a water efficiency update.

MR. SHIRAKH: Okay, we heard the comment. Any other comments?

MR. WARE: Thomas, please introduce yourself.

MR. TRIMBERGER: Thank you. This is Thomas Trimberger, I'm with Bureau Veritas. It kind of took me for a little loop with that second chart for the June 9th. But I guess my first thought was that none of the charted houses on there would meet under the yellow line. But those are measured in a different way, is that my understanding?

MR. HOESCHELE: Correct, Tom. That's right. So the orange line is the plan view measurement, which is a direct linear measurement.

MR. TRIMBERGER: Okay, so some of those may in effect fall below the other line if you measure them differently. Okay, I'm happy with that then.

A couple of other comments. One as far as education. I've been the building official field for some quite some time and we've been for years educating people to size water lines large enough. So to start telling them to size them smaller is an educational challenge. And, you know, it makes sense if we can tell them to make them shorter, but to make them smaller is not only a new concept but it could be contrary to what we've been telling them for a long time. There are regulations in the California Plumbing Code that have minimum sizes for water lines. So if we're going to have minimums and maximums it gets a little tricky.

MR. HOESCHELE: So the thinking is by limiting the one inch what we are wanting to happen is that instead of having one main trunk line that it just gets split earlier and transitions.

MR. TRIMBERGER: Okay, I can see that.

Another issue about adding another HERS rater is another HERS visit. This is an inspection that would typically happen during the framing stage of construction so you are – I don't know if you've got other HERS issues that are happening at framing. You know, some of the QII stuff could be. But if you're building houses and if you're adding – if you've got one HERS requirement at final and then you have to add a second one at final that's not going to be very expensive. But if you're adding a whole other visit that could be a little bit more costly.

Those are my two comments.

MR. SHIRAKH: Good comments, Tom. Are you still with Rancho Cordova?

MR. TRIMBERGER: No, I'm not. I'm with Bureau Veritas.

MR. SHIRAKH: Oh, okay. Well, congratulations.

Okay, again, what Martha and I at least are thinking is that the HERS verification should be a compliance option and not part of the prescriptive package.

MR. TRIMBERGER: Right. And even as a compliance option I did like that. But just looking at, you know, it could be a whole other visit if you're hitting something at framing that you don't already have inspections going on at frame. That was my only concern.

MR. SHIRAKH: I understand. Thank you, Tom.

MR. TRIMBERGER: You bet.

MR. RAYMER: Tom is a very smart man and we agree with him.

MR. SHIRAKH: Bob thinks you're a very smart man, I just wanted to relay that to you.

MR. TRIMBERGER: Keep the faith, Bob.

MR. RAYMER: Love ya.

MR. SHIRAKH: And he loves you, too.

Any other comments?

MR. TRIMBERGER: That was all I had, thanks.

MR. SHIRAKH: Thank you. Any other comments on this, the compact hot water or anything that Marc presented?

(No response.)

So we're going to have Owen briefly talk about the showerheads, which is a related topic.

MR. WARE: There were a few comments.

MR. SHIRAKH: Oh.

MR. WARE: Going back what Jim said about whether water was considered in this situation. He was referring to the price of water and wastewater.

MR. SHIRAKH: I think we understood Jim’s comment. You know, Marc will look at some kind of tradeoff.

MR. HOWLETT: Okay, thank you. So, Mazi, what would you like me to do in terms of timing?

MR. SHIRAKH: You know, we have until four, we can probably go a few minutes past if you must.

MR. HOWLETT: Okay, so this is a measure that is new to Title 24, it’s something that has not been regulated before. So what we were trying to do as we developed this was make sure that we were not trying to push the envelope too much. We’re staying within some fairly conventional bounds. And perhaps with the next code cycle, if this raises no objections, it might push a little bit further.

So what we’re proposing is to limit the showerhead flow rate in new construction to 2 GPM measured at 80 psi. That is in line with I think with current, not proposed, but current language in CALGreen. And also it’s in line with the federal water standard. We are also requiring that only one – sorry, we’re requiring that a shower valve be installed for each showerhead. So you can't have a shower valve that controls multiple heads, you have to have a shower valve that controls only one head. The intent of this is to try and encourage people just to use one shower instead of using lots and lots of showers all at once. Because the multi-head showers are really a drain, not only on water but also on energy.

I have a couple of notes here. One is that the federal – there is a recently issued federal interpretation of the existing showerhead standard. Because what manufacturers have been doing was attaching multiple showerheads into a single unit, sort of, you know, welding them together and saying that because each individual showerhead was under 2.5 GPM then this was a compliant device, even the total flow rate of the whole thing might have been 10 GPM. So the federal government issued an interpretation that said that was not really what they had intended in writing the standard in the first place and that interpretation is going to become live two year from now. So that will be before the implementation date of the Title 24 standards.

And also a little bit of housekeeping. The last time we talked about this we had a proposed requirement that the supply pipes be no wider than half an inch at any point from the manifold. We had a chat with Marc Hoeschele and the Commission and we decided that that would be dropped and it was incorporated into Marc’s proposed language.

So here are some data showing that – well, there was a concern when we started out with this that if the showerhead flow rate dropped people would just take longer showers. You know, how much water it took to wash the soap of your body was basically a fixed number and you could either have that amount of water delivered slowly over a long period of time of quickly over a short period of time. There was some pretty good existing data from several very in depth and, you know, peer-reviewed good published studies that showed that there was a slight tradeoff. You can see in the graph here, there was a little bit of a variation of shower volume with flow rate. But the ultimate effect was that when you reduce the shower flow rate the shower volume also drops. So we're getting energy savings that are pretty much in line with the reduction in flow rate.

These are the numbers for those of you who are really concerned with the numbers and have a feel for what they mean. We looked at four different studies that had taken place over a number of years, which were field studies of showerhead retrofits. So people had gone in and put in 1.8 or 2 GPM showerheads as a retrofit for 2.5 or 3.5 GPM showerheads. And they found that there were consistent savings.

The other main issue, apart from would this thing save any energy, was how would people feel about it? Would people say, Well, this tiny pathetic little dribble isn't really any good and I'm going to go and unscrew it and fit in the highest flow rate showerhead I can find. There are two field studies and one lab study that directly address this. The two field studies were pretty large retrofit studies that were direct replacement studies. They went in and replaced people’s existing showerheads with a new showerhead. The results of those studies were essentially that there were almost no user complaints. We contacted the authors directly to confirm that and it was true, the studies had asked about user acceptance and the acceptance was very high. There was also a lab study conducted by Robert Morris and Associates, that was a PIER-funded study. And I will talk about those results in a second.

So, as I said, the field studies both found high acceptance, 69 percent very satisfied, 23 percent somewhat satisfied and a few people who were not satisfied. In terms of a program dropout rate that’s pretty good compared with other energy efficiency programs. The Robert Morris lab study was a very extensive, thoroughly designed research study in which multiple subjects were given multiple different showerheads at different flow rates. And he did find that there was a – I think I’ve got a graph of it here, yeah – he did find that as the flow rate increased the overall satisfaction increased.

This graph is a little bit counterintuitive because lower is better. So as the flow rate increases you can see the overall satisfaction trends toward the 1 end, which was the high satisfaction end. It's a pretty low correlation. So, as you can see, the little dots are spread out around the graph pretty widely. So R-squared is the standard way of quantifying the correlation between two variables in a scientific study. This R-squared of 18 percent shows that there is connection but the connection is pretty weak. And what Morris concluded from the study was that there were a lot of other factors that affected peoples satisfaction with showerheads apart from the flow rate. The flow rate was a factor but it was a weak factor and there were lots of other factors that were more important. So his conclusion was it's possible to design showerheads that have a very high user acceptance at 2 GPM but it just requires a little bit more effort on the part of the manufacturers.

Now, we looked for our part of the study at the pricing and availability of showerheads. We surveyed the complete product range of 22 manufacturers, which between them account for almost the entire market. That was a total of 160 models. And the average flow rate of those showerheads is 2.2 GPM. So on average they are very close to the existing federal max of 2.5 GPM. What we found is that the purchase price was not dependent on flow rate at all. So there were some very cheap showerheads at 2.5 GPM, there were some very expensive showerheads at 2.5 GPM. So there was a very high variation in price at that 2.5 GPM flow rate but at the lower flow rates they tended to be lower cost showerheads. There weren't any very expensive showerheads at very low flow rates.

So what we concluded from that is that there is no added cost for this measure at all. If anything, we could actually prove that the cost was less. So the whole issue of cost effectiveness with this measure is not relevant. So here you can see the average purchase price as related to flow rate. Really what lays behind this data is that that tall bar on the right-hand side means there are a few very expensive gold-plated 2.5 GPM showerheads which bring the average price up.

Another question we wanted to answer was how prevalent of an issue is the multi-head shower issue, how many multi-head showers are out there, how many people have showers installed that are 5 GPM or 8 GPM. There was a study by Seattle Public Utilities in 2006 and they found that 15 percent of the people they surveyed in that year had showers with more than one head and of those people the average number of shower nozzles was 2.6, which equated to a 6.5 GPM average flow rate. So these showers are using 2.6 times as much energy as regular showers. I think we dropped off the end of the slide here. But the other study on this was by Biermayer of LB&L and he found by looking at manufacturer’s flow rates he found the average flow rate of a multi-head shower is 5.5 GPM. So those two studies agree pretty closely.

Prevalence, we didn’t find any data on exactly how many multi-head showers are out there but we found good evidence that it’s increasing. So therefore because it’s increasing it’s found its way onto various kinds of commercial market assessment studies and we think therefore that it’s worth the Commission regulating this thing because it seems to be becoming more common over time.

So here again are the numbers. I mean, obviously moving to a lower flow rate shower does save a lot of energy and water. So this is what these numbers show.

So the proposed language is here. Section 101, we are proposing a definition of the word showerhead. Now this is redundant with the current federal interpretation of the federal standard. So this is saying more or less the same thing the federal standard says. But we wanted to make sure this was in Title 24, just in case the federal interpretation changes, which we obviously hope it doesn’t but there is always a chance that it will. So this simply means that a showerhead - you can't weld four showerheads together and call it a showerhead. Four showerheads welded together is four showerheads and not one.

And the proposed language for Section 113 is that a showerhead must be installed. So when the inspector looks around the house there must actually be a showerhead on each pipe, you can't just leave the pipes headless and let people install their own showerheads. And the showerheads that are installed must have a 2.0 GPM limit. We've put an exception in there for showers that recirculate hot water from the drain to the showerhead. Now, there are not very many of those unless you go to Australia where they have quite a few showers that do this but they are not very common here, at least yet.

Oh, I think I'm missing a slide there. We had another – oh, no, we're not missing a slide. Sorry. That language is all that we are proposing. So questions? Thank you.

MR. RAYMER: Yes, Bob Raymer with CBIA. A couple. I just would like to bring to your attention that HCD's adoption of Part 11 includes provisions for multi-showerhead fixtures. And they're also proposing to modify that language in the 2010 interim update that is actually coming to a conclusion right now. At the July Building Standards Commission hearing HCD is seeking adoption of the following language – this is their modified multi-showerhead language, Section 4.303.2 of Part 11: Multiple showerheads serving one shower – When a shower is served by more than one showerhead the combined flow rate of all those showerheads controlled by a single valve shall not exceed the maximum flow rates at 20 percent reduction -in the particular column that they’ve got, or table that they have – or the shower shall be designed to only allow one showerhead to be in operation at a time. And they they’ve got the exception, the maximum flow rate for showerheads when using the performance method specified is 2.5 GPM at 80 psi.

So what you’re proposing, this would take effect in 2014. But it is in contrast, it is in conflict with what HCD has adopted for the Green Building Code in Part 11 of Title 24. So that’s going to have to be kind of worked out. I understand that maybe these things are becoming more popular but then again I think we built 11 homes last year. So, you know, there can't be too many of them out there.

My other point involves the exception. Am I to understand that the exception here – take me for example. I’m taking a shower, the shower is hitting me, going into the drain and that water gets recirculated and I get hit in the head with it again?

MR. HOWLETT: Yes, that’s right.

MR. RAYMER: And I would try to market that to the public?

(Laughter.)

MR. SHIRAKH: Hopefully you didn’t have too much beer the night before.

MR. RAYMER: You know, particularly after a long day of fishing and drinking beer. Just a thought.

MR. SHIRAKH: I don’t know if we need that exception.

MR. HOWLETT: We included that because we had actually found these things on a market survey and some people apparently enjoy, you know, showering in their own juices. So that’s up to them.

MR. SHIRAKH: Owen, I think there are some exceptions we can do without. So I guess the main comment is that our requirement is in conflict with the Green Building Code, so I’m not sure how we’re going to – do you have any opinion about that?

MR. RAYMER: I think the key point here is the existing standards and the proposed standards that are being adopted at the July hearing this year. Those standards will take effect in July of 2012 so it’s not like what you’re proposing is creating necessarily a conflict with what HCD will have in 2014. But I would strongly encourage you to work with HCD to make sure that as you go forward with your set of standards and their update of the 2013 standards that will take effect in 2014 that you work this out.

MR. SHIRAKH: Okay.

MR. HOWLETT: Well, that seems like a question for the Commission really in terms of like where the language should live. We spoke about this a couple of weeks back and because showers use so much energy and comparatively a small amount of water the rationale was that this requirement should really be in Part 6 rather than Part 11. But that's beyond my particular company's control.

MR. SHIRAKH: Okay. George?

MR. NESBITT: George Nesbitt. Now the federal rules have clarified that you can only have one showerhead, one manufactured showerhead per valve. So wouldn't that preempt California's Green Code?

MR. HOWLETT: It's not a preemption. It's just an agreement. It's just the same requirement.

MR. NESBITT: Right. And –

MR. HOWLETT: A preemption is exceeding the federal requirement. All we're doing is we're echoing it, we're replicating it.

MR. NESBITT: I'm saying – yeah, I mean wouldn't the federal code sort of make the California Green Code non-compliant?

MR. HOWLETT: Well, that's what we're –

MR. RAYMER: I'm sorry, the key point here is it's illegal. Building Standards Commission has to pass everything on a nine point criteria. One of those criteria, I believe it is criteria number one, says the code cannot conflict with another building standard that the state adopts. And so it’s an important thing and that’s one of the key functions of the Commission, to make sure what HCD, the State Fire Marshal work together and what the Energy Commission and HCD work together. So they can't adopt –

MR. NESBITT: But I thought federal regulations took precedent. So anyway, I guess is it okay to have two heads as long as they don’t operate at the same time?

MR. HOWLETT: Correct, yes.

MR. NESBITT: Okay, so that –

MR. SHIRAKH: They have to have separate valves. You can use them both at the same time you just –

MR. NESBITT: Right.

MR. SHIRAKH: You can't turn on one valve –

MR. NESBITT: And have two heads come on.

MR. SHIRAKH: -- and have five heads come on.

MR. NESBITT: Right.

MR. SHIRAKH: You can have five heads with five valves.

MR. NESBITT: Right. Could you have one valve with multiple heads but they can't operate at the same time?

MR. HOWLETT: Yes.

MR. NESBITT: And is that reflected in our language?

MR. HOWLETT: I hope it is.

MR. NESBITT: Or by – because what I’m thinking of is, like, my parents’ house where we, you know, replumbed the shower and we also have a hand-held showerhead as well as a fixed head with a diverter at the moment. Actually, pretty much you have to – it can only operate on one or the other. So I think –

MR. HOWLETT: Because of the federal ruling it means that any showers that function in that way from mid-2012 – I’m not sure of the exact date – but any showers that function in that way have to have a diverter that does not allow both heads to function at one time.

MR. SHIRAKH: You still have one head that comes out of the wall.

MR. NESBITT: Yes, you have one head operated by one valve but then you can only use one head at a time. Yeah, I think definitely having a single head operated by a single valve certainly is hopefully a discouragement to the big project I did last year. The architect had to apologize to me that the client chose body sprays. I’m not sure how many valves they have.

MR. HOWLETT: What we need is to be careful not to outlaw, you know, locker rooms. Because we couldn’t write a requirement that says you can't have multiple showers in a room because then nobody could have locker rooms. So this is a way around that.

MR. NESBITT: Well, what they do in the locker room is they go and turn all the shower valves on and then leave.

But, you know.

MR. SHIRAKH: Okay, well it’s ten after four. I would like to kind of wrap it up. Mike?

MR. HODGSON: I just think so we’re clear, the CALGreen code as it’s being proposed says you can have multiple showerheads on the single valve but only one showerhead can operate at one time, which is consistent with the federal standard.

MR. SHIRAKH: Okay.

MR. HOWLETT: Yes, we didn’t actually see the proposed Part 11 language. So we will review that and just make sure in detail that it’s all in agreement.

MR. SHIRAKH: Okay, thank you. Any other comments on showerheads?

(No response.)

Anything on – as long as we don’t recirculate I think we’re okay.

MR. WARE: Yes, a message from Tom Trimberger at Bureau Veritas. He is also a little concerned with the reducing in sizing of piping. He says, In my experience as development occurred water districts had trouble maintaining pressure. As water pressures reduced complaints increased.

MR. HOWLETT: So just to clarify, we were thinking of proposing a reduced pipe diameter as a requirement but we dropped that and we agreed that the language that Marc put forward earlier today was what we were all agreed on.

MR. SHIRAKH: So they can run 3/4 inch.

MR. HOWLETT: They can run 3/4 inch as long as it's insulated.

MR. SHIRAKH: As long as insulated.

MR. HOWLETT: And they can run one inch for 10 feet.

MR. SHIRAKH: Any other comments in the house on anything that was presented today all day?

(No response.)

Anything online?

(No response.)

MR. RAYMER: I have a question in general.

MR. SHIRAKH: Sure.

MR. RAYMER: Given that we are – Bob Raymer, CBIA – given that we are not having the meeting on the 14th and that is being moved back – and by the way, I talked with a few, we're good with particularly Friday, July 15th, I'm good for July 12th. But it would be very helpful to get a few of the packages as early as possible, not all 16. But we would be especially interested in getting our hands on 10 and 12, Climate Zones 10 and 12.

MR. SHIRAKH: Yes. And actually I know that Wilcox is working fast and furious and we will probably have some data to you ahead of that.

MR. RAYMER: Okay. Bruce doesn't mind working harder so I would support that. Thank you.

MR. SHIRAKH: We are going to be back here tomorrow again at ten o’clock. It’s going to be mostly envelope measures, mostly nonres, there is one residential issue. Hodgson will probably be interested. I think it’s like one o’clock, right after lunch, it has to do with cool roofs and roof deck insulation. And then the next workshop is going to be on the 21st, those would be the ACM Manual modifications.

So, thank you, everyone. And we will see you tomorrow morning.

(Adjourned at 4:13 p.m.)