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CALIFORNIA ENERGY COMMISSION

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Residential and Non-residential)
Buildings)

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FRIDAY, JULY 15, 2011
9:30 A.M.

Reported by:
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P R O C E E D I N G S

JULY 15, 2011 9:31 A.M.

MR. SHIRAKH: We should get started. Welcome, this is the July 15, 2011 Staff Workshop. We have a few topics to present today. After the introductions, the first topic is going to be the 2013 Residential Package A, which is the staff's recommendation for the Prescriptive Package for the next round of Standards. And that is going to be presented by Bruce Wilcox, who is sitting to my right, to my left is Martha Brook, we are the co-leads for this round of Standards.

At 11:00, approximately, is going to be the recommended Mandatory Requirements for Ceilings, Walls, Floors, Fenestrations and Ducts. And after that, Bruce will talk about the Zone Air Conditioning Measures. We'll break for lunch and then come back, start with Advanced Envelope Measures, and then the Non-residential, the only topic of the day with the Non-residential Guestroom Occupancy Sensors. And then we should probably be able to adjourn about 3:00.

I have my presentation here, but by popular demand, I'm going to skip most of it, I know Mike and Bob are really looking forward to it.

So, the only thing I'm going to show here is basically the schedules. So this is the schedule that

we've developed for this round of Standards and we're pretty much down here, we're wrapping up the staff workshop process and, after this, we're going to be creating the complete draft for the 2013 Standards. We should be available in the September-October timeframe. And then, soon after that, we'll start the Rulemaking process, the 45-day language, and the 15-day language if needed, and we're hoping for adoption in March of 2012. The publication date of the entire Building Code is going to be July of 2013 and the effective date, we hope, will still be January of 2014.

Previously, we talked about having some workshops next week on July 22 to present the REACH Standards; we're not going to have those workshops. And, instead, we're proposing another, probably hopefully the last workshop is going to be in mid-August, the date to be determined, and in that workshop, we're going to present the so-called "Hollywood House," production model homes for orientation, glazing and PV tradeoff, you know, we're going to mention this briefly today and this is an attempt to allow a tradeoff between photovoltaic and glazing in a dwelling. This will get tradeoff against the 20 percent total area limit and the five percent west facing glass. And there are several approaches you can take to accommodate this and we'll present those in the

August workshop.

One of the items that was pulled from today's workshop was the Refrigerant Charge and Verification because we're still working with HRA and the manufacturers on some of the things we're recommending, so we pulled that from today's workshop and it's going to be presented in August.

And we're also recommending a bunch of changes to the administrative sections, Section 10-103 through 114. This would impact the forms, but mostly it's going to impact the way the compliance options and things like that are treated in the future. And we'll also have a brief discussion of the REACH Standards and how we're going to approach it. Essentially what we're doing with the REACH Standards, we're going to go to a target, a savings beyond the Base Code -- a percentage, and the percentage may be the same for all climates zones, it may vary, and then what we will do, we will develop packages which will go into compliance manuals, as recommended for reaching those targets. So that's it for me, unless there are any other questions, I'm going to turn it over to Bruce.

MR. WILCOX: So –

MS. BROOK: Hold on, Bruce. I just wanted to mention that there's a package like this out front that

hopefully everyone grabbed because some of the slides that Bruce is going to show is going to be easier to read off the paper.

MR. WILCOX: Thank you, Martha. That's what I was going to say. You could argue that this whole presentation has way too many numbers, but that's just the way it is.

So what I'm going to present is an analysis and discussion and a proposal for what we're going to call Prescriptive Package A in the 2013 Standards. Is that better? It works? Okay. That's a change of name. This is what is currently called "Package D" in the 2008 Standards, and so we're trying to rationalize the standards and make them simpler, so we're going to make it Package A. It's the basic prescriptive requirements for new residential construction. And just to make sure it's clear, "prescriptive" in California doesn't mean the same thing as "prescriptive" everywhere else in the world; in California, the Prescriptive Standard essentially defines the level of performance that's required in new buildings, and it's used in what we call the Standard Design for the Performance Analysis Compliance Method to establish the performance that's required for any proposed building. Except for mandatory features, which we're going to talk about in the next

presentation, none of these Prescriptive requirements are absolute, all of them can be flexibly traded away for other measures at the builder's option, as long as they show that their performance is equivalent to their house, with all of the Package A Prescriptive measures, then they comply with the standard.

This analysis is based on a combination of the P2700 and P2100 prototype houses, the 2100 is a 2,100-square-foot, single story house that is defined in the Residential ACM Manual, and the 2700 is a two-story slightly larger prototype house that is also defined in the ACM Manual and we've used a combination of the results for those two houses, and we've also used the combination of the results for shingle roofs and titled roof as representative of construction in the state, as well as the variation on the 16 Climate Zones.

This analysis does not include any energy savings or costs for the Zoning measure, which we're going to discuss later on today. It doesn't include any of the costs or savings for the Solar Ready Measures, just so it's clear what we're talking about here. And in doing this analysis, we've assumed that the 2013 AFUE and 2015 SEER EER Requirements that have recently been announced by DOE are in place and, so, those are part of our analysis for both the Base case and the proposed Measure

Package. What are they? The DOE announced recently that, in 2013, the Furnace AFUE will go up to 80 percent; in 2015 for southwestern states, including California, the SEER will go up to 14 and the EER will go up to either 11.7, or 12.2, depending on the rate of capacity of the air-conditioner. So, for this analysis, we've assumed the 80 percent AFUE is in effect, the SEER 14, with an EER of 12.2. So these standards are scheduled to go into effect a year before the DOE --

MR. SHIRAKH: I'm getting looks from the Court Reporter. Please come up to the podium. The last comment was, what, Bob Raymer, he was wondering what the requirements were, the year, for the 2015 requirements.

MR. WILCOX: Okay. And the other background piece of information here is that the results here are for single family homes, only. We haven't included any results for multi-family in this analysis, and we've weighted the results by Climate Zone according to a set of Housing Start predictions that were developed by the Case Team. So when we say the statewide impact is X, that's determined by using the results from each climate zone, weighted by the number of housing starts expected -- or the fraction of statewide housing starts expected in each Climate Zone.

Okay, so I'm going to present actually four

packages, but here is the first part of this, has got a comparison of three different packages of measures. And the packages are shown up here in the upper left, Package A1, which represents a maximum cost-effective TDV savings package for all the measures that we analyzed. And the way we created that is that we looked at the lifecycle cost-effectiveness of each measure --

MR. KEESEE: I'm Mike Keese from SMUD. Could you describe what's in each of the packages?

MR. WILCOX: We're going to get there in a minute, Mike. I'm just giving you background.

MR. KEESEE: Thank you.

MR. WILCOX: So the Package A1 represents the most efficiency measures that you could put into the house without making it cost more than the same house would have cost under the 2008 Standards. Well, it's not the most measures, it's the most energy savings that you could get from a package of these measures without putting in so many things that cause more than 2008, so that's one definition of what "cost-effective" means. We save a bunch of energy and it still costs less on a total life cycle basis than it would have cost under the previous versions of the Standards.

Package A2 is an alternate approach in which we've picked the lowest lifecycle cost set of measures in

each climate zone, so this is the set of efficiency measures in a house that, when you consider the first cost plus the present value of future energy costs, the total life –- the sum of those is the lifecycle cost and that package represents the lowest total lifecycle cost for all of the packages, all the alternates that we could analyze.

And then the third package is the staff's proposal for this Package A, and it's a less aggressive energy efficiency proposal than either of the other two, but we're going to talk about all three to kind of put things in perspective here. The Package 1A, the maximum package, costs on a statewide basis about $5,500 plus per house, added costs compared to the current Standards. It saves 44 percent of the Time Dependent Valuation, TDV energy compared to the 2008 Standards. For historical comparison purposes, it saves about 31 percent of the energy when you calculate it using the older source rules, and then the savings are also listed there for Kilowatt hours, therms, and kilowatts, as well. The Package A2, lowest lifecycle cost package, costs $3,900 roughly and saves 39 percent TDV, and the staff proposal costs a modest $2,882 and still saves 33 percent of the TDV energy. You can see in the bar graphs all the same information graphically. So now we'll go on and talk

about the details, but first a little for those of you who are kind of into engineering science approaches, this shows, for each of those energy calculations, the savings in percentage terms vs. the first cost and there's a slight amount of linearity there that might be of interest.

So here is the "too many numbers to look at" presentation and there are a lot of details in this package stuff, so we're trying to be really upfront and just show what it is, and I will go through in some detail this one just so we understand what it is we're looking at, and then we'll go on to look at the rest of this package and the other two, yeah, the three packages.

MR. KEESEE: Excuse me, Mike Keesee again from SMUD. Could you define the peak period, where you're getting the savings?

MR. WILCOX: We could do that. Should we do that now, or can we wait until we get done with answering your first question before we answer your second question?

MR. SHIRAKH: I think we should go through the package and then, once we're done, then we'll take questions.

MR. WILCOX: Okay. So, this table is laid out with the 16 climate zones down the left-hand climate here, Climate Zone 1 through 16, and then there's a set

of columns which are the main efficiency measures that we've considered in putting the packages together. The first column is the ceiling insulation and roof truss, and so R-38 RHT means that Climate Zone 1 in this package, we have R-38 ceiling insulation and RHT stands for Raised Steel Truss, which is a type of roof truss that has certain efficiency advantages compared to Climate Zone 16, which has an R-38 Standard truss which is the type of truss that is predominantly used in California at this point.

And those of you who are familiar with the Standards will see that the insulation R values are the same as the current 2008 Standards, so, for this set of analyses, we did not consider anything in terms of sealing our value other than what was in the current Standards. We did look at alternative trusses.

The second column -- there is somebody messing with my screen –

MR. WARE: Hold on just a second.

MR. WILCOX: Okay. So the second column has to do with the outside reflectance of the roof surface, the cool roof characteristics of the roof. And for this package, we're showing a tile with a .2 solar reflectance for all the Climate Zones, and this is the basic proposal that the staff is putting forward, that the requirements

for tile would change from .15 reflectance, which it is under the 2008 Standards to .2 reflectance. The other requirement for shingle roofs, our proposal is that that remains the same as it's been, which is a .2 reflectance in Climate Zones 10 through 15, and no requirement in the other Climate Zones. So this column is basically static in this set of proposals.

The third column is Domestic Hot Water Heating System and what we're requiring here is a package of measures which includes a compact hot water distribution system, increased piping insulation for large pipes, and a limited length of large pipes as part of the distribution system. This is being proposed, it was developed as a utility sponsored measure and is being proposed as required in all new single-family houses, in all Zones. And that's what the "Required" in this column means. The Glazing Package is the one that was proposed by the Case Project and it's been presented earlier in staff workshops, and basically it is a U Factor .32, a solar heat gain of .25 in the hot climates, and the same requirements in the gold climates, except the solar heat gain coefficient is relaxed to allow higher solar gain in the cooler climates. That's also a constant in all of these packages, alternate packages we're going to be looking at.

So the fifth column is the Insulation R Value of the duct system that is located in unconditioned spaces; in California, that's primarily in the attic. And in this package, we're showing R-8 ducts in all of the climate zones except for Climate Zone 6, 7 and 8, which are the mild Southern California coastal zones. And otherwise, we're increasing the R Value of insulation to R-8.

The next column over is the Air Conditioning Air Flow and Fan Watts Requirement, and the proposal here is that we extend the current prescriptive requirement that is in Climate Zone 10 through 15 to all the Climate Zones, hence they're required in all 16 zones. ACH50 is a measure of the envelope air leakage of the house, it's measured by a blower door test and the proposal would be that each house would have to have a blower door test to show that they had reduced the air leakage to the level specified, three levels are specified here, ACH50 of 3, that's three air changes per hour of air through the blower door at 50 Pascal. There's a second level which is 4 ACH50, and then the 7.6 in one Climate Zone is the default level, that is the current default in the 2008 Standards and would not require a test, that's basically no requirement.

The fourth column is called QUII and that stands

for Insulation Construction Quality Inspection and this is a measure that's been defined in the Standards since 2005, and it's been an optional credit, and in this package, that would become a requirement in all Climate Zones. And it requires a special inspection to show that the insulation was installed without defects.

The next column is the roof deck insulation and this is a measure in which the insulation is added to the roof deck at the top of the attic to reduce heat flow in and out of the attic, primarily to reduce heat flow down in the summer time, and reduce cooling loads on the house and reduce duct losses from the attic duct system. For this package, there's a mixture of R-13 Batt insulation which would be installed below the roof deck, inside the attic, and R-8 insulation which would be installed on top of the roof deck as a foam layer.

The next column has to do with the radiant barrier and ventilation in the attic. Radiant barrier are required in a number of climate zones currently. And this "No" here means that it's not required and "RB" means that it is required, and because of the R-13 insulation installed inside the attic, it's an unfaced Batt, there's no radiant barrier possible when you have this measure, so in these zones we have no radiant barrier, and in the zones where there is an above deck of

insulation for the roof deck, then we're assuming the radiant barrier is still possible and that is what is required in this package. We've made a significant change in the treatment of attic ventilation in that we're, rather than the 2008 Standards, which has requirements for the attic ventilation area and the location of the vents, the proposal here is we would stop doing that and really require a minimum ventilation as required by the Building Code. And so that is reflected in -- the "/300" is the common designation for one set of minimum ventilation requirements, which is one square foot of ventilation-free area for each 300 square feet of attic floor area, so 1/300. And then the final column here, it is the wall insulation. And in this proposal, we've increased the wall insulation requirements vary significantly to require 2 X 6 framing in all the 16 climate zones and, in most zones, R21 insulation in the cavity with an additional R4 foam sheeting layer around the outside. So R21/4 means that it's an R21 insulation with an R4 exterior foam sheeting layer on the outside of that. And then, in addition, we considered requiring 24-inch center spacing for the framing in this wall and it turns out that, if you assume that that doesn't cost anything, which is one popular assumption, that it's always cost-effective, and so that's what ends up in this

Maximum Cost-Effective Package in every climate zone.

So that's the Package A Maximum Cost-Effective Package. And then the other half of this table, which unfortunately I can't get on the screen in this format here at the same time, is a similar table, same columns, and the contents of the column are the added first cost to implement this measure in our typical house, you know, representing a combination of the two-story and one-story houses with and without the shingle roofs and tile roofs. So this is a way of looking at what the first cost is and establishing the lifecycle cost calculations.

A positive number here means that it costs more to do this measure than what was required in the previous standards, so as you can see, there's $427.00 in all but one of the zones for the ceiling insulation and that's our estimated cost for the Raised Steel Truss, which is an upgrade vs. the Standard Truss since Standard Truss is allowed under the current Standards and, in Climate Zone 16, we have a Standard Truss and there is no cost upgrade for that.

So each one of these columns, the numbers here represent the dollars per house required to pay for the measures that are proposed in the standard as an upgrade from the 2008 Standards. And I don't want to go into great detail here, but you can see there is, you know,

costs for most of these things. We're not changing the roof reflectance for asphalt shingles and the Energy Commission's analysis indicates that the .2 reflectance tile is actually a no cost upgrade, so there is no cost for the roof reflectance stuff.

The Domestic Hot Water Heating Package is estimated at $306.00 per house, the glazing package at $388, the Duct R Value depends on where the starting point was and whether we ended up at R8 or R6, but that's $152 for the R8 and $36 to upgrade to R6. The Air Conditioning Air Flow Prescriptive Package is estimated at $200 ACH50, depending on the level, is $813 or $656, QII is $709, etc. And over at the right-hand side, we have the total added cost, which for this package ranges from a high of $5,900 and some to a low of about $4,900, and the statewide average weighted cost is $5,559.

If you look at it zone by zone, this is the 16 climate zones across the bottom, and this is the percentage energy savings compared to the 2008 Standards for the blue bars are the TDV Energy and the red bars are the source energy, and the one on the right here that says "Weighted" is the statewide weighted by construction starts average savings. And so, for this package, we're about 45 percent savings on TDV and about 30 percent savings on source energy. And the kilowatt hours,

kilowatts and therms, are similarly.

So that's sort of everything, almost everything, we could find to analyze that gets into this package in terms of being cost-effective by the current adopted lifecycle cost methodology if you make this assumption about maximum savings at no more than the current cost.

The second approach here is picking the lowest lifecycle cost in these climate zones, instead of the most energy savings in each climate zone. And this changes the measures that get included pretty significantly. You notice that, well, it doesn't change the roof surface for solar reflectance, or the domestic hot water heating, or the glazing because those are assumed, and we didn't actually analyze alternatives for those in this analysis, so they're assumed to be in the package because there's very strong analysis in their individual proposals.

In the roof, we get Standard Trusses instead of Raised Steel Trusses in about half the Climate Zones when we go for lowest lifecycle cost. We get R6 in many more Climate Zones, and R8 in only a few, about half R8 and about half R6.

We've assumed the Air Conditioning stuff is required, still, and that wasn't included in the Lifecycle Costing here. And the Air Leakage Reduction

for the Envelope, that's not cost-effective in the mild coastal climates and the R3 very tight envelope is only cost-effective in Climate Zones 9 through 16. And the QII, the Insulation Construction Quality, is cost-effective in the more severe climates, but not in the less severe coastal climates. Whole House Fans, which is the Ventilation and Cooling column here, are cost-effective in Climate Zones 8 through 14, and so they're in the minimum cost package. And the roof deck insulation changes to be in fewer climates and to be more R13 and less above deck, which the R13 is a less expensive alternative. And if we get some radiant barriers and zones where we didn't have it before, it's because of the interaction with R13.

The wall insulation doesn't change as much. We back off to R19 in several zones, but we still end up with 2 X 6 in all of the climate zones if we do this low lifecycle cost approach. Again, the lower table here shows the assumptions on the added cost. This package reduces the added cost to $3,894, weighted statewide, and there's a different pattern of the added cost in each climate zone, you can study that if you are interested. Again, a different pattern of TDV and source savings, but it's all laid out for you.

And then we have package A3, which is the staff's

proposal for what should be adopted into the Standard. So this is – you want to focus attention here and discussion here, if possible.

So one of the goals here, there were several goals that were used to put this package together, this package does not have as many measures as the lowest lifecycle cost package, so clearly, maximum energy savings wasn't the goal here. One of the goals was to make the Standards more understandable and clear and less complicated, so there's been a tendency to group climates together and use the same measures in groups of climates, so there is, for example, the ACH50 column, we only have ACH50 of 4, and the 7.6 default, which is basically a No Requirement for these zones. So, rather than having a mixture of three ACH53 in some zones of 4 and others, the attempt here is to make this as simple, you're either in a zone that requires it, or not, and it's always the same requirement. There's no QII –- well, the other goal here was to reduce the first cost to less than the full lowest lifecycle cost package, so there were measures left out in order to reduce the cost. So, for example, these are all standard roof trusses and it's all with the 2008 R Values, so the proposal here is to not change the roof truss or the ceiling insulation requirements from 2008, which saves costs compared to the previous package,

there's no QII, no insulation quality inspections required, so that saves cost, the whole house fan requirements are still the same, but the roof deck requirements are cut way back so that there's R4 foam above deck required in Climate Zones 9 through 14, and R8 in Climate Zone 15, but no requirement in the other zones, so that's a significant statewide reduction in cost. And the wall insulation requirements are significantly scaled back from the Lifecycle Cost case, although there is still more insulation required than in 2008. So there is one way to look at this package is that, in all the zones that they currently require R13 wall insulation, which is Climate Zones 2 through Climate Zone 9, through Climate Zone 10, so all these – the milder parts of the state, 2 through 10, currently require R13 wall insulation, so in those zones the requirements increased R15, which is a slightly higher density of fiberglass Batt, plus an R4 sheeting. And in the current zones that are already requiring 2 X 6 walls with R19 insulation, or R21 insulation, the change here is to go all those zones to R21 and then add the R4 foam sheeting. So, the big change here is to essentially require R4 exterior foam sheeting in all the climate zones, but not to change the framing to require 2 X 6 framing. And the result of this package comparatively,

the added cost decreases down to $2,882 for our combination of typical houses. And the wall systems are significantly less expensive, the roof decks are significantly less expensive, etc. No cost for the ceiling. And that's how the cost reduction happens. And again, we can see the statewide energy savings is a somewhat different pattern, but we still manage to get a little over 30 percent TDV savings and about 20 percent source energy savings from this reduced package of measures.

So when we discuss this with -- we've been looking at this and beating around on the actual proposal, and talking about it with various people, and one of the concerns that was raised had to do with the air ceiling that was required in a bunch of the zones. And so we looked at an alternate staff package, so basically we're presenting two alternatives here, A3 and A3B. And this comparison here is a comparison between those two packages and the three packages I just discussed where we have an alternate that I'm going to add on here, which is A3B. As you can see, the cost is very slightly higher. The energy savings TDV terms are almost identical. It's basically in many ways completely equivalent package and what we've done in A3B is we've taken out the requirement for low leakage ACH50 Blow Door

Testing of the houses in all the zones and replaced that with the insulation quality procedure being required in the more severe climate zones, so it would be required everywhere except Zone 6 through 10. And this is essentially the same cost and essentially the same energy savings and, from the staff's point of view, this is equivalent and equally acceptable. It is the staff's position that they're interested in energy savings and results and not particularly wedded to any particular measures to get there.

So that's, I guess, if you want to look at the staff's proposal in summary, there are two alternatives here, one is the A3 that we discussed, and the second one is this alternative that is slightly different, but about the same savings and cost. Both of those cost slightly less than $3,000 and both of them save about 33 percent of TDV energy.

So now we can answer questions, or take comments or – yes, okay, so to answer Mike Keesee's question, what we're presented here is a new estimate of peak effects, which is one that was developed by the consulting team at E3 in San Francisco. It's related to and derived from essentially the TDV metric that's used for the time dependent valuation that is used to weight the value of energy on an hourly basis in each climate zone, and it's

significantly different than what people are used to seeing in the past. In the past, the idea was that you were looking for the absolute peak hour, or the absolute day with a peak hour period of several hours on that day and judging the peak reduction based on one day, or one hour, that represents the worst of the year. This new method that is being shown here is based on looking at the hundred worst hours of the year as rated by TDV valuation in each climate zone, and looking at weighting the peaks during those 100 hours by the TDV value for those hours. So the highest TDV valued hours get the most weight, and then using that to estimate the peak demand for each measure package house, whatever.

So one of the things that happens is it doesn't weight the absolute peak hour nearly as highly as when you only consider the absolute peak hour. If there are a lot of hours that are less severe, I think E3's argument is from a utility system perspective, that they think that is a valid way to look at the cost and savings on peak measures, and so they proposed that and it's in the methodology document, and we're calculating it here. It's clear that, as we get these big percentage savings number here, you wouldn't get that big a number of savings if you looked at one hour, the absolute peak of the year, in most of these climate zones, I think. Mike,

you have to come up to the front.

MR. KEESEE: What's the time? What's the time of those hours? Is it 4:00 to 5:00, 5:00 to 6:00, 7:00 to 8:00?

MR. WILCOX: Well, it's related to your other favorite topic, the TDV Value stuff, which is based on statewide demand and distribution in each climate zone, and so forth. It's a combination number, and so there isn't any particular hour, and it's not determined by the clock, it's determined by the model.

MR. KEESEE: It should be determined by the time --

MS. BROOK: We can actually summarize that and provide it to you, but right now we're doing it automatically by 8760 Stream and letting the model compute it, but we can summarize it for you.

MR. KEESEE: You know, because we know what it is in our climate zone. It's 4:00 to 7:00 p.m.

MR. SHIRAKH: It is, but unfortunately we have to use the statewide and we can't use climate zone specific --

MR. KEESEE: But you just said you calculate it for the 100 worst hours in each climate zone --

MS. BROOK: That's right.

MR. KEESEE: So I'm curious what it is --

MS. BROOK: We'll summarize it for you --

MR. WILCOX: Well, and I have a bunch of information for you, Mike, that I haven't tried to compare yet in detail, but I think that's the next step, to answer your question.

MR. KEESEE: Thank you.

MR. SHIRAKH: So I want to kind of re-emphasize one of the points that Bruce made. He presented two packages which are staff recommendations, and they basically have the same TDV and source energy savings, but different measures. And the point of that is that, you know, what we're interested in is the savings, not necessarily how we get there, as long as we get there, you know, we can accommodate -– the package, A1, that he presented basically has all the goodies in it, and we can probably reach in there and pick measures that are more palliative, in fact, we can build packages that are different and are all equivalent, which has been our goal all along. And as you commented, it would be helpful to help us understand what the concerns are and how we can actually do these substitutions.

So, with that, I'd like to ask if anybody has any –- Bob.

MR. RAYMER: Thank you, Mazi. Bob Raymer with the California Building Industry Association and I have

several questions and comments. First off, when would you like to have comments back on this latest set of releases?

MR. SHIRAKH: We're saying three weeks from now, that would be August 12th.

MR. RAYMER: The 12th, that would be much better, okay.

MR. SHIRAKH: August 5th, I'm sorry, Friday, August 5th.

MR. RAYMER: Okay. That's tight, I understand, probably another week would be very helpful on that.

MR. SHIRAKH: Would August 12th be good?

MR. RAYMER: Yeah, that would be much better.

MR. SHIRAKH: Okay.

MR. RAYMER: Thank you. On some specifics here, during the case studies, I believe it is the one, the last one held at UC Davis, I presented some information that had been passed on to me from the timber industry, in particular, the California Forestry Association, the Western Wood Products, and there was one other group, these are all entities that we work closely with in the development of the Green Building Standards adopted by HCD and the Building Standards Commission. And they had, you know, I have been trying to keep other groups apprised of some of the things that you're proposing

here, it's been a relatively moving target, but in particular with the timber industry, they were quite concerned about making a quantum shift to 2 X 6 and 2 X 8 studs; certainly, you can do that, there are very effective examples of that being done, particularly going to 24 on center, the problem here is, apparently, according to them, going to 2 X 6 and 2 X 8 results in the need for more trees being cut down because you're taking things out of the center cut, you know, if you're using linear programming, I guess you're not really maximizing the amount of board feet, in particular, coming out of here. They can explain it much better than I, but they were seriously concerned that, inadvertently, this could have an unintended environmental impact of being able to build a more efficient home, but having to cut down more trees in the process. And that is something you should probably take up with them, and I can certainly put you in contact with the people that provided that information, first.

Also, with regards to marketable packages, as always, we will be doing now that we're getting a clearer picture, particularly, of Package A3 and 3B, we will be looking at those and, particularly with Con-Sol will be looking at marketable packages that they've been using in the past and how to integrate all this into where the

building industry is today and we would like to, of course, work with you and bounce some of these figures off. I know, in terms of energy consumption, Con-Sol has already discussed working with Bruce and Ken Nittler on energy analysis. We'll also be looking at what is this impact on marketable cost, marketable designs, and all that. So we would also like to bounce some of that information off of you to make sure that we're not using inappropriate assumptions. So, we look forward to working with you on that. Obviously, you know, not to beat a dead horse, but with the economy where it is right now, builders, those who are building, are going through some massive cost cutting procedures right now and many of them are dusting off plans and getting ready to go forward –- very slowly, I might add -- and they're completely unaware of what's being discussed here. And so, like I've said many times before, there's going to be a huge educational effort that's going to be needed, particularly in 2013, so that these individuals are not necessarily blindsided by some rather significant design changes that they have to now incorporate into the plans that they're submitting in late 2013, early 2014. Thank you.

MR. SHIRAKH: So, on that training and education, we have started dialogue with the IOUs and we're hoping

we can get some help from them and actually we would like CBIA to consult with part of this group to develop these programs and --

MR. RAYMER: We would love to help you with that. We can kill a couple birds with one stone, the training stuff that we had previously done incorporated both Green Building and Energy, we kind of maximize the number of people attending it because some had more interest in Green Building than energy and vice versa. I can tell you with the changes that are being proposed here that there's going to be a huge interest in this. And for both building officials, subcontractors and buildings. Thank you.

MR. SHIRAKH: Thank you, Bob.

MR. FRANCISCO: I'm Jim Francisco, I'm with Sierra Consulting, they represent some of the contractors in the state that do foam work. And before that, I worked with NCFI out of North Carolina, a foam manufacturer.

I'd like to bring up a couple of points that, during that time, you had proposed a 2 X 6 before, and we were concerned about what it would eat up as far as the environment, so we went to the US Forest Service in Washington, D.C. and asked them to use their computers and using California's average building rate to tell us

what was going to happen as far as the environment. They came back and told us, by using a 2 X 6 rate, you were going to have to cut down one and a half more trees per house that went up, and that it had the potential of deforesting at least 192 square miles a year. That's canopy that they didn't feel they could lose. They were really concerned about it and, at that time, they did call CEC and talked to them about it, but that has been an ongoing concern of all of us with the environmental issues on this.

MR. SHIRAKH: I think, if I may just add one point. What we're proposing here is basically the basis for the U Factor for the walls and you can get to that U Factor any way you want.

MR. FRANCISCO: Okay, you should put a package forward to get to it in another way using the 2 X --

MR. SHIRAKH: Right and the proposal is that, you know, we're going to have a table that is going to have a U Factor based on these assemblies, you can get there any way you want, as long as you meet or beat the U Factors. You could go with 2 X 4 with an inch and half of foam.

MR. FRANCISCO: Well, the gentleman who spoke before me was right, you take the center cut out of a tree, so you use more forest.

MR. SHIRAKH: We're not disputing that.

MR. WILCOX: Actually, to be clear, the framing requirement in the staff proposal is identical to the 2008 Proscriptive Standards, so there's no change in the Proscriptive Standards here in terms of the framing assumed.

MR. SHIRAKH: Mr. Hodgson.

MR. HODGSON: So let's just continue that. Mike Hodgson from Con-Sol representing CBIA. So, the U Values that you'll be using for the packages will reflect the same framing that's in the 2008 Standards, which is my understanding is 16" on center, not 24" on center.

MR. SHIRAKH: Right.

MR. HODGSON: Okay, so if I take a look at Climate Zone 11 in Package A3, B, it says R21, you're going to put a 2 X 6 stud in there with a R21 batt and 16" on center. Okay? So, questions or concerns. I'm not sure –- I presume eventually you're going to get to Mandatory Features and I'm not sure if that's today or not, but I think it is later, right?

MR. SHIRAKH: Right.

MR. HODGSON: And there's a concern -- I'm just going to try to go column by column here –- on Domestic Hot Water about the pipe lengths and the limited pipe length, I think, that is still unresolved and probably a significant concern to the industry because that

especially becomes a mandatory feature and I'd like to find out how common a practice it really is. I think there is a misconception between staff, consultant, and the field, and we need to clarify that. The framing issue, it sounds like we've talked about. On glass, the concern I have is the solar heat gain coefficient, it's significantly lower than what most manufacturers in the market are using. I understand the presentation was that people can do it, but when you actually go to the big box stores that were quoted as actually carrying this product, over 60 percent of their product wouldn't meet the .25. There's other issues. You should take a look at some of the big box stores and walk through them and find that there are no labels on the windows, and that would be helpful if you could encourage window manufacturers to label their products. However, Energy Star's newest version of Windows, which is -- excuse me, the Energy Star requirement Version 5, which is their newest version, recommends a solar heat gain co-efficient of .30 in this climate zone. And actually there's a couple of climate zones that they have for California, but that would be the more stringent one, and that's the one that we think the manufacturers who are now national manufacturers are shooting for. So this is going to be a different target and we would prefer a target of .30.

The other issue I think we have is we're still concerned about putting any type of insulation on the underside of roof decks or on the top of roof decks. As I mentioned in previous comments, the American Plywood Association has put out a release in the spring about concerns about moisture on covering roof decks, either from spray foam on the underside. I'm not sure about -- they're really not a technique that's in the marketplace of putting in residential housing R4 or 8 on the topside, so I don't think they've addressed that yet. But I think we need to have a serious conversation with that product manufacturer and the trade association as to whether or not that is a concern. With lower levels and just possibly R4, and that's being possibly a staple product or something like that, rather than a blown product that may resolve the issue, I don't know, but I think that's something we should explore before we go too much further.

MR. SHIRAKH: Can we just respond to that? Do you want to talk about the building science?

MR. WILCOX: Yeah, we have a project underway to analyze moisture concerns related to roof deck insulation and we have a draft report which is not – we haven't completed reviewing it, so it hasn't been posted, but it will be very soon, and so I think we're trying to answer

that concern in a pretty detailed and scientific way.

MR. HODGSON: Yeah, and I appreciate that and we'd love to see the report; my concern is, when the primary manufacturer and the trade association that represents that manufacturer says "don't put this stuff on my roof deck," and that's probably too strong a statement, but, "we have concerns when you put these things on my roof deck," concerns tend to lead to warranty problems and liability issues is what the building industry is very concerned about. So that's -- I'm not saying it's not a good thing to do, I think we need to explore it and find out where those concerns come from, and resolve them if we can prior to making this requirement.

MR. SHIRAKH: But they're saying, even above the roof deck it's a problem?

MR. HODGSON: Mazi, they don't really see above roof deck insulation, so they haven't addressed that. What they have seen is spray foam on the underside of roof decks and that's what they're addressing in their technical report, so I'm not saying there's a problem above, but the issue is basically covering up a roof deck when it's moist with a product that's not that breathable.

MR. SHIRAKH: I mean, the way that physics works,

it actually makes sense when you have the insulation below the roof deck, the temperature of the interface of the roof deck and insulation will be lower. When the insulation goes above the roof deck, the temperature actually goes up at the lower part of the roof deck, which actually helps in not having moisture problems.

MR. HODGSON: Okay, so I just think there's a fairly –- this is not a California issue, it's a national issue and it's come up in the recent adoption of National Codes and Green Codes, and so there' a fairly active discussion about it and there's people whose livelihood and manufacturing products depend upon this, and so I think they would be the experts and we would love to see the report.

MR. WILCOX: One of the issues, Mike, you said it's a national problem and I think one of the issues is that it depends on climate to some significant degree. And so we've done the analysis specifically for the California Climate Zones, and I think the results are actually probably significantly different than you would find in many climates in the United States.

MR. HODGSON: Yeah and it sounds like we've had that discussion with these folks and it seems to be about 20 inches of rainfall is where they start to get worried, that's the Central Valley, and I know it's not Las Vegas

and that's where most of this building science has occurred is we've put this in Las Vegas, it gets 2.7 inches of rainfall. And, you know what? There's no moisture problem there. And there is some correlation to climate. So, I'm just saying it's an issue and we need to explore it. We don't want to induce a liability here or something that voids warranties on roof for structural failure.

MR. WILCOX: Yep, absolutely. We're trying to be very careful of that.

MR. HODGSON: One, I really appreciate –- or, we really appreciate staff's 3D proposal, we are very sensitive to the ACH50 issue, it's not bad building science, we just don't understand indoor air quality and I think, together, Mark has invited us to a workshop next week or something that we can push and hopefully add comments to say let's explore this issue and find out more about it. And then, Bruce, you offered other potential alternatives would make there and other issues, which I would love John to be involved with, Mr. Proctor, as soon as we can. So I think that's a very positive response. We have some issues, obviously, with lumber, with roof decks, with domestic hot water. We've resolved the issue with air changes, which is great, so we'll continue the dialogue and look forward to those

discussions.

MR. SHIRAKH: Thank you, Mike, appreciate it. Jamy.

MR. BACCHUS: Jamy Bacchus, Natural Resources Defense Council. And I would concur that I applaud the Energy Commission's review of all these different measures together and I would encourage them to push for whatever is cost-effective, whatever you show to be cost-effective. We're looking at the broader goals of 2020 at being Zero Net Energy for residential construction, we need to make some marked changes within the 2014 Code Cycle and hopefully by 2017, we'll finish it up, but otherwise it could be a very sharp drastic turn by 2020 to try to make up whatever we miss.

MR. SHIRAKH: Do you want me to respond to that?

MR. BACCHUS: Please, sure.

MR. SHIRAKH: You know, you were showed two packages, the A1 and A2, which are everything that is possible, but, again, I think Bruce explained the goal, you know, we're not trying to get to Zero Net Energy in just one cycle.

MR. BACCHUS: Yes.

MR. SHIRAKH: And we're not indifferent to what the market conditions and so forth that are going on, we're trying to balance the goal of Zero Net Energy with

the realities of the market, so we're getting pushed from both directions and, so, our proposed package is an attempt to basically try to bridge that gap. And, you know, we have two more cycles after this.

MR. BACCHUS: Yes.

MR. SHIRAKH: If you look at A1, if we did everything that is A1, essentially we'll get almost over to zero net energy goal that we had set forth earlier, but we can't do that in one cycle, it's just not realistic.

MR. BACCHUS: Oh, I don't think we could hope to achieve it in one Code Cycle. I'm just making sure that we're on track and we do the things that we're showing to be cost-effective today.

MR. SHIRAKH: I think we agree with that.

MR. BACCHUS: Martha, did you want to add something?

MS. BROOK: Oh, I just wanted to mention that I think we need to be careful when we're thinking about – when we're saying statements like we think we're going to meet the goal of Zero Net Energy because we're only – these analyses are only looking at regulated loads, and ZNE's definition is all loads in the building, and so we know we also have to be very aggressive with our appliance efficiency work in the coming years and, so,

anyway, just a caveat there that, you know, these goals, the savings that we are expecting and we are planning for are aggressive, but it's a small part of the house's overall energy use, so we need to keep that in mind. Another reason they keep pushing hard.

MR. WILCOX: Yeah, and another thing, just to make clear, the Package 1A that I presented doesn't include all of the measures that are possible. That analysis was focused on the base code here, not on Zero Net Energy, so we didn't look at a lot of the more exotic and expensive possibilities, including many of the things that were looked at and proposed in the case projects. You'll see in the case exterior wall analysis that's going to be presented this afternoon, there's lots of system there that are proposed, that have higher performance than anything we considered in our package analysis here.

MS. BROOK: The other thing I think is important as kind of a way to characterize these packages in our proposal is that we really are thinking about the envelope in a major way for this standards update because we think that the path to zero really should be focused on the envelope first, and trying to reduce the loads in the envelope to the greatest extent possible, and then looking at systems. So we do have some work in water

heating distributing and air, you know, air flow and duct sealing, but most of our focus is on the envelope this time.

MR. BACCHUS: I would concur. The active systems should follow after all the envelopes are addressed, reducing loads as much as possible, and then focusing on the energy efficiency. That's the right loading order. I will add that Air Change 3, 50 Pascals, isn't really necessarily a measure of indoor air quality, it's just how big or how small your holes are on your envelope, and not where they occur, but just how many you have. So, I wouldn't construe the two together, that if you want effective indoor air quality, you really need mechanical ventilation, and I think Title 24 in a Mechanical section addresses that in its requirements for toilet exhaust.

MS. BROOK: Right. Yeah, you're right and it does, but one of the issues we have is that we just instituted –- we just created that requirement in 2008 and we really don't have any good field data that says that it's serving up everything that we expect it to serve up. So that's one of the issues, was really depending on that and making that a defense for everything that we do for tightening the house because we don't have the data to support that what we've tried to do is actually working.

MR. SHIRAKH: In fact, one of our sister agencies, the ARB, has issues with this proposal, so….

MR. WILCOX: You should dialogue with ARB.

MR. BACCHUS: Yeah.

MR. SHIRAKH: George?

MR. NESBITT: George Nesbitt, Environmental Design/Build, CalHERS, Passive House California. Okay, I had been waking up at 6:00 a.m. every morning, so I did not set my alarm. I woke up at 6:00 a.m., and then at 7:00. So I rushed out of the house without my hat, I got to AmTrac and the train was on the platform and it left, so there you have it. So I ended up driving and hopefully I will save more energy by my efforts here than I expended getting here. And I take my hat off sometimes. It gets serious when I take my hat off, then you've really got to worry.

Question on packages. Can anyone tell me what percentage of compliance is done with the package or proscriptive method for new construction, even? Do we know --

MR. WILCOX: Well, I don't know that we have any recent solid statistics, but the thinking is that it's less than 10 percent.

MR. NESBITT: Right, so from a new construction perspective, and compliance, most of its performance, so

really exactly what the package is doesn't matter because when you do the computer, you do whatever you need and you've got to get the equivalent savings. But when we get to alterations, you're probably driven a lot higher percent of the time by the package requirements, so we are then essentially specifying exactly what you're going to do because, if somebody is going to do a roof, or windows, they're usually not going to go through, you know, if they're doing one measure, even several measures, they're not going to go through and do a performance tradeoff; if they're doing an addition, you know, a remodel, then they might, or are more likely to. So, in that sense, I agree that what the exact mix doesn't matter, as long as the savings are equivalent. And I want to reiterate Martha's statement that we need to focus on the building enclosure first. All my calculations on existing buildings show I can usually save more energy by improving it than by putting in the best mechanical system. So, and that's also the passive house approach, of course, is build a very energy efficient enclosure and need to make up very little with the mechanicals.

So, the other thing is, when I approach existing buildings, I will not insulate without air sealing first. So the question is, would it be more important to try to

get an air-tightness first than to increase insulation levels? You know, we can keep throwing more insulation at the problem, although we are getting, you know, some of the building practice has tended to get us a little tighter, we're really not anywhere close to what we need to be. So, I would say, even before we put more insulation in, that insulation needs to be installed right; before we install the insulation right, we need more air tightness because, if there is so much air waving through it, most of it is not going to work as well as it should, so I would say we need to focus on the things like air tightness, QII, before we focus on adding more insulation. I also have to agree with CBIA on the sort of roof deck insulation.

There's a lot of things in our industry people don't understand and don't do right and that causes lots of troubles and I think this is one I'm not -- I know what the goal is, I'm not sure -- I'm not sure it would be a good thing to do yet, I think it's something we need to look at harder and longer. And luckily, since 2014 is a ways off, we have some time for education in the mean time. And then, also, if we do want to increase insulation levels in walls, I say staying with 2 X 4 and going to continuous exterior insulation is a lot better approach than typically just going to a 2 X 6, or -- I'm

a little worried about a lot of our passive house projects going to 2 x 8's but not eliminating the thermal bridging, so as we make a wall thicker, make it better insulated, we've reduced its capacity to dry, there's no enough energy to drive through and drive the moisture out anymore. So, really, we need to focus on things that eliminate condensing surfaces and the easiest way to do that is exterior insulation, so that the Package 3B is mostly a default of a 2 X 4 with exterior, until you get into 11 through 16 plus one. But, as an approach, that's something we should promote over just building a thicker wall. And I'll leave it at that for now, I guess.

MR. SHIRAKH: Okay, thank you, George. Mike.

MR. KEESEE: Mike Keesee again, just a couple quick questions. I'm assuming LCC saved is in TDV Values? That column?

MR. WILCOX: It's in dollars.

MR. KEESEE: It's in dollars.

MR. WILCOX: It's the net present value of the lifecycle cost savings.

MR. KEESEE: Would QII apply to roof deck insulation?

MR. WILCOX: Yes, if it's fiberglass.

MR. KEESEE: Okay. How about for the rigid?

MR. WILCOX: Well, we've -- there's going to be

argument that QII should not apply to rigid insulation and I --

MR. KEESEE: Does it currently apply?

MR. WILCOX: What?

MR. KEESEE: Does it currently apply?

MR. WILCOX: I believe it does, but mostly because of the way the QII credit is structured, it's based on the U Factor of the wall, so it applies to the combination of both.

MR. KEESEE: Right.

MR. WILCOX: And so --

MR. KEESEE: So that would have to be verified.

MR. WILCOX: Yeah, the proposal is that it be separated in 2013, QII would not apply to exterior sheeting.

MR. KEESEE: But that's not what's being proposed here.

MR. WILCOX: That is what is being proposed --

MR. KEESEE: That is being proposed, so that no rigid would have QII?

MR. WILCOX: That's right. And, in fact, the QII that is the lifecycle costing here is not including any impact on foam sheeting.

MR. KEESEE: Okay. I'm assuming, but if you could confirm, that you're still defining a whole house

fan as the on-the-floor belt-driven type?

MR. WILCOX: Yes.

MR. KEESEE: In your work on air-tightness, I'm assuming also that it's still -- it's not true mechanical ventilation, but you're using just exhaust fans for your ventilation?

MR. WILCOX: The standard references actually 622, which allows several different ways to do that ventilation.

MR. KEESEE: And what did you assume in your costing for that?

MR. WILCOX: There's nothing in here about costing for indoor air quality ventilation --

MR. SHIRAKH: We're not changing anything.

MR. WILCOX: We're not changing any of that at this point.

MR. SHIRAKH: Still the same as 2008, so we're not --

MR. KEESEE: So the cost for getting down to a lower ACH50 is just ceiling cost?

MR. SHIRAKH: That's right.

MR. KEESEE: Okay. What was the last one -- I'm returning back to peak, you can tell what's on our minds, do you have numbers also on relative numbers of kWs saved? Like an average kW saved over that average 100-

hour period?

MR. WILCOX: Well, what that --

MR. KEESEE: Can you tell me if it's like 2.3 kW?

MR. WILCOX: I don't have that in any of these reports, but we know what that is and we could figure it out. I think the thing to do, Mike, as I said, I think we should sit down and look at your idea about what the kW is and compare it to what we got here and generate the numbers you'd like to see.

MR. KEESEE: Fine, okay. I look forward to that, thanks.

MR. SHIRAKH: Thank you, Mike. Mike Gable.

MR. GABLE: Mike Gable, Gable & Associates. Just to follow-up on the comments on the alterations, I think that there are some practical problems with alterations, how you meet some of the proposed requirements and it would be good just if staff made a notation to look at maybe an alternative set of proscriptive requirements for alterations only. My concern is that you would be driving the market toward a performance approach for every time someone does an alternation, unless you can maybe rework some alternatives to the way the proscriptive requirements fit together as an alteration. Specifically, for example, the exterior wall insulation with the exterior foam, obviously, is an alteration

having a part of a wall that you're going to change with that requirement. In a larger home, it's not too practical. So, maybe there's a way of putting into the standards an alternative package just for alterations to address those. So that's my only comment.

MR. SHIRAKH: Yeah, we have thought a little bit about it, I mean, in fact, if we end up with any kind of a roof deck insulation, that will not be a part of the alterations for the same reason you are --

MR. GABLE: Okay.

MR. SHIRAKH: -- describing. But I think that's a very important topic. Alterations are totally different creatures.

MR. RAYMER: Bob Raymer, CVI, kind of like the cool roof alteration that you gave a half dozen alternatives, that would be perfect here.

MR. SHIRAKH: Right. Mr. McHugh.

MR. MCHUGH: Mr. Shirakh. Jon McHugh, McHugh Energy. I just have a couple of comments. I guess the first comment is that, if I look at the lowest lifecycle cost package, if I understand this correctly, on average, this has basically a benefit cost ratio of around 2:1. Is that correct? It might be because, if I look at the lowest lifecycle cost, it says the savings on average, - well, I don't know, the savings are somewhere around –-

you haven't weighted it, you've only weighted the cost increase, right?

MR. WILCOX: Yeah.

MR. MCHUGH: But the lifecycle savings is somewhere which is, in addition to that first cost, I'm guessing somewhere around $6,000, or something like that, so that means that the dollar savings is something around $9,000, maybe I'm wrong here, maybe it's a total lifecycle cost energy savings is around $9,000, and our first cost increment is the $3,900, so probably somewhere between a B/C ratio of 2 and 3 for that lowest lifecycle cost. I understand it has a large first cost, but it's something to consider in terms of what is our policy goals for Title 24.

The next comment is around the issue of saving wood and the issue around 2 X 6 construction. And as long as I can remember, 2 X 6 construction has proscriptively allowed someone to go to 24" on centers and, in fact, I was looking at something on the Internet that related to structural engineering and he was citing, I think it was a 1993 Uniform Building Code, which has those tables of spacings for studs, and so even way back then, and up to the current California Building Code, 24" on center is proscriptively acceptable for those kinds of walls, which is up to two stories, you know, so the 2 X 6

and 24” centers, you don’t have to do any framing or anything like that to support a two-story building.

Now, I heard earlier that Mr. Raymer and the fellow from, I guess, Sierra Consulting, was talking about the issues on our forests associated with construction, and yet I’m hearing that, as our proscriptive baseline for those framing categories where we’re using R19 in the cavity, which would be a 2 X 6 construction, you’re just not going to be able to hit that with 2 x 4’s, that the proposal be that we base those U Factors on 16” spacing. And if you think about, okay, so we’re trying to do something right for the environment in terms of using less wood, we’re trying to do something right in terms of the environment, in terms of saving energy, so in 24” spacing as a lower U Factor, and at the same time, the building industry is describing concerns about cost; surely, putting less studs in the wall reduces the cost of the wood for that building, what is possibly the rationale for using 16” spacing for those building constructions.

The other thing that’s been brought up is concerns about the ACH –- the three air changes per hour at 50 Pascal. My understanding is that this is the basis of the 2012 ICC which is the basis of the National Energy Code, you know, ultimately California is going to need to

show that our building standard is more energy efficient than that national standard, so this is the basis of a standard moving forward. Yes, it's not typical practice now, but given that there's something like 14 states that use the ICC, clearly the building industry is going to figure this out over the short term. So, the question is, regardless of whether we pick ACH3, ACH4, 7.8, is there not some particular benefit to having some actual knowledge by the people sealing the building what the feedback is? And, you know, this just goes back to the issues associated with duct sealing. I was involved in this about 15 years ago, we worked with various contractors and they said, "Come visit our buildings." And so they're picking their better buildings and, you know, we would then bring someone with a duct blaster to those spaces and they're picking their best buildings – it seems like every time we went to a building, there was a problem because the contractor was not getting the correct feedback in terms of "is my duct sealed well enough?" Well, the similar kind of discussion is likely true for the sealing of buildings, unless you have this kind of feedback, you don't know what you're getting.

But nonetheless, I think it's appropriate that, you know, these are proscriptive, they're not mandatory, there's different options that are available, and so

tradeoffs with QII probably makes a lot of sense and, of course, there's all the other measures that the state is not allowed to address, such as equipment efficiency. So, for any builder that is worried about liability associated with any of these measures, whether it's roof insulation, sealing their building, whatever, they have an option to look at something that I don't think anyone is really worried about being sued about in terms of purchasing a higher EERSER piece of equipment or higher combustion efficiency equipment.

And then finally, in terms of insulation, my understanding for roof deck insulation, my understanding is that something like 50 percent of roofs are tile, is that about right, Bruce?

MR. WILCOX: Eighty percent.

MR. MCHUGH: Oh, 80 percent --

MR. SHIRAKH: In new construction.

MR. MCHUGH: In new construction. And it's also my understanding that, for tile roofs, the opportunity exists actually to put the insulation on top of the roof deck and my understanding, all the concerns about moisture have been with insulation below the roof deck, so it's my take that there is a substantial opportunity for significant savings for that 80 percent of the market. I'd like to hear your thoughts, Bruce, on the

issues associated with moisture when the insulation if on the top of the roof deck vs. the bottom. Thanks.

MR. SHIRAKH: Well, before -- your very first comment about the cost benefit ratio, were you suggesting that we're not aggressive enough in our staff recommended package? What was the ––

MR. MCHUGH: You -- I think that could be an interpretation, something to think about that, you know, everybody is concerned about the economy, the issues associated with unemployment, you know, we're not in a good situation right now, you know, the building construction industry has been a –- I spent a good part of my teens and all of my 20s in the construction industry, so it is really an important part of our economy. That being said, you know, the average cost –- I just looked on Zillow the other day -– the average cost of a house in California is $300,000, and when you start looking at the issues associated with what has partially been behind some of the problems we're seeing has to do with people being able to not afford the combination of their mortgage and their energy costs. And everything that you're proposing here, all the way up to your highest package, is something that reduces that combination. So, the question is, you know, what is in the best financial interest of the state? And this

question about trying to not be so aggressive that you're increasing the first costs so much, but is that really in the best interest of the state? So, when we have a situation where, when you look at the total of your mortgage costs and your energy costs are being substantially reduced by going further than your preferred package, it raises a policy question.

MR. SHIRAKH: Okay, thank you. I will let Bruce respond to that more.

MR. WILCOX: Our understanding of the primary moisture problem with insulated roof decks and attics is a winter problem that has to do with moisture condensation on the roof deck, on the inside, and this already can happen and that's why we need added ventilation. And you make the situation worse when you insulate on the inside with a vapor permeable insulation because the roof deck gets colder when it's insulated and so that the tendency for condensation is increased. So the primary focus of our concern here has been the below deck fiber glass insulation and looking at what the potential is for moisture problems there. If you put insulation above the roof deck, then in the winter time the roof deck is warmer and the condensation potential goes down, there's less condensation issues, less condensation problem than you would have if you had no

roof deck insulation at all. So, I think the focus here has been on the less expensive, below deck, fiberglass insulation option as being the one we have to worry about, and so that's what we've looked at most intensively and that's what the big study is about, and I think we'll be able to satisfy the concerns hopefully with the analysis that's been done. I haven't heard of anyone who is worried about moisture problems when you insulate above the roof deck. Maybe Mike is worried about it, I don't know, but….

MR. SHIRAKH: Okay, Pat.

MR. EILERT: Pat Eilert, PG&E. So, I have a question for Commission staff, specifically.

MR. SHIRAKH: Martha.

MR. EILERT: You first, Mazi.

MR. EILERT: So, I'm following up on this issue of what's driving the decision-making here because, you know, if we look at Package A2, for example, that's clearly cost-effective and I haven't heard anyone sort of say that it's not feasible. I've heard people say that they don't want to do it, so I'm sort of wondering what the criteria are for moving to something different from A1 or A2.

MS. BROOK: So I guess I'll start and then Mazi can chime in. I don't have a long history with Standards

development, but just in the last few years, I have learned that we have many constraints when we are making those policy decisions about how to go forward with the Standards update and they go beyond the lifecycle cost metric, so we have always considered first costs of the affordability, product availability, federal preemption, all these things are constraints that we -- I describe them as constraints, I mean, we also have to consider all those things, as well as make sure that the package is lifecycle cost-effective. So, in my opinion, that's what we're doing with our staff proposal is that we're – and also enforcement and compliance, so trying to get less variability across climate zones for compliance and enforcement purposes. So all of these are additional constraints that we have when we're going forward and making a recommendation for an update and I'm pretty sure you can find all those things in the Warren-Alquist mandate, but, you know, it would be an exercise that we could do, but I'm pretty sure that there are additional concerns that we are required to consider.

MR. EILERT: Would you agree -- what I always hear about, and I haven't read Warren-Alquist lately, it's feasibility and it's lifecycle cost, and you're saying that, if affordability is in there, well, you know, we're talking about $3,000 or $4,000 here on E2

relative to a $300,000 home, that saves the inhabitant a lot of energy here, so I'm just still not quite getting where these decisions are coming from.

MS. BROOK: And I think that, you know, we are going to be briefing our Management, basically the Efficiency Committee, and explaining all the issues, both sides of, you know, the full range of perspectives that we're hearing through these workshops, and they're going to help us make those decisions because, you know, that's what their job is, is they have to weigh the balance the same as we do --

MR. EILERT: But how did staff come up with the decision for A3 when A2 is clearly cost-effective and it's feasible?

MS. BROOK: I think I've tried to explain it to you, that we are also trying to help with compliance by having more consistency across Climate Zones, we're trying to figure out where there is risk that we are – that where there hasn't been a lot of construction practice that we, then, need to figure out how many different options we can allow that sort of moves that construction practice forward without the risk that it's never been done in the nation; so, for example, even though 3ACH50 is in the I Codes, how much of it has actually been done? I mean, we know it's being done on

existing buildings, we need somebody to step up and tell us that “it happens all the time,” “there’s no indoor air quality issues,” “here’s all the data to support that on existing buildings,” that would go a long way for us, but you have to really push on that for new buildings. We are not hearing anybody coming up to the table to tell us that and to provide that information to us, so it makes it difficult. So those are the kinds of things, feasibility, you know, it still has to have field demonstration of that and so a lot of our decisions, you know, we’re challenged by paper studies vs. field experience, and we need more and more of the latter and we’re encouraging people to step up and help us with that.

MR. SHIRAKH: See, Pat, if lifecycle costing was the only criteria, we wouldn’t need these workshops, I mean, you could just demonstrate this is cost-effective and be done with it, but it never worked like that, there are all these other factors that Martha described. Again, even, take the roof deck insulation as an example, it hasn’t been done. You know, we have some simulations, we’ve contracted with someone and now he’s done models, but to know for certain that this is going to work? You can’t just jump to A1 and say “these are all cost-effective,” and you can put it in there. You know, our

own Commissioners, the Legislators, the Governor's Office, they're all very interested in this, they want to move towards zero net energy, they want aggressive goals, they may or may not agree with what you are recommending, but they are also all going to consider what is the real impact of this, whether this is feasible and it can be done, people are going to get sued or not, you know, what kind of training and education you need, can we do that in the timeframe that we have left, we have to really look at the whole spectrum before you come up with a final package.

MR. EILERT: I appreciate that and I'm not proposing that we jump to something that's not feasible, I just, you know, some of the specific arguments here around some of these issues are just part of the proscriptive baseline and this is ultimately a performance approach here, going forward. I'm just saying that I haven't heard compelling arguments why we can't move to something like an A2 yet.

MR. SHIRAKH: If you look at the difference between Package A2, which is the lowest lifecycle costing and what we are proposing, it's about 3 percent. Again, the package A1 is potentially what will take us to zero net energy, but nobody said we're going to get there in one cycle, you have two more rulemakings beyond this one,

and you've got to go in a way that is not disruptive to the market, and people can understand it, they can build it, and you know, it's --

MR. EILERT: Okay, so I guess what I'd really like to see is, you know, a bit more definition about what the criteria are, about what's a solid proposal and what's not because, you know, there's been a lot invested in developing these proposals for the Commission and, you know, it just seems like it's a moving target to figure out what ultimately gets recommended and what doesn't. Thank you.

MR. SHIRAKH: Thank you, Pat.

MR. FRANCISCO: Jim Francisco, Sierra Consulting. Last time we were here, Mr. Varvais and myself, gave cards to you and told you, as far as closed attics, decking, we would take you to live situations and we'd like to share that information with you. So I'd like to reiterate that we're open to bring our experts in, give you our studies, and take you out on field trips to show you where it's being used.

MR. SHIRAKH: Okay, thank you. Abhijeet.

MR. PANDE: Abhijeet Pande, Heschong Mahone Group. Two comments, one, I would like to support what John mentioned earlier about an alternate package where the builders are prepared to use higher efficiency

equipment and they can trade away features that they may not like in the base package that you guys are recommending here.

Second, ACH50 and going back to Martha's comment, I agree that we need to have field data, but we do have field data based on work that was done for PIER and for the utilities, and on average, if I remember correctly, the results are that houses are being constructed more tight than the 7.6, which is what we have in the Standards, so we can argue that a 3, a 4, or a 5 is right, but the fact is that most of the homes are tighter than what we are assuming they are. So what is the harm in reducing the level to where houses are already?

MR. SHIRAKH: Well, one thought is that, on your comment on having alternative packages that have high equipment efficiency, that is certainly something we're going to be talking to CBIA and Con-Sol. You know, again, we showed one alternative where, you know, you do away with ACH50 and QII, there are other tradeoffs definitely possible. George.

MR. NESBITT: George Nesbitt. This is a good time to bring it up, as I've been bringing up the issue of existing buildings and alterations on a lot of the various topics that have come up, I suggest that we do have a workshop just on applying the Code to existing

buildings and alterations because the Package A is, of course, the basis for what you've compared to. And also, the complexities, as Ken Nittler has told me and I've also read the Code, of how complex it is to figure out how you actually apply things. We have gaps and, you know, we've got people opening up walls and they don't even bother to insulate it, the Code doesn't say you have to, but if you have to put in a window, you've got to meet Package D. Plus, although (modeling) existing plus addition is so easy to comply with, the way you get compared if you do not come up to the current package requirement, you then sort of get penalized in a way. So I think there are a lot of issues around existing buildings and existing plus addition that really deserve -- even if it's only myself, Mike Gable, and Ken Nittler, and maybe Pat Splitt, but you know, it probably deserves a public hearing.

MR. SHIRAKH: I think we agree with you, George. Alterations definitely need special attention. Mike.

MR. HODGSON: Yeah, I just wanted to reiterate that I think that's a very good point, the alterations section is really a across the counter, it has to be user-friendly and some of the features in Package A are going to be very difficult for retrofit markets to do. Walls was brought up, I'd like to bring up solar heat

gain coefficient, those issues, we're going to have to think those through in order to make sure they're practical.

But I wanted to bring up a couple of other things that we really haven't talked about, but are in your packages, one of which is QII. We've mentioned before numerous times that the implementation of that in the field is difficult and not very uniform, and so we really want to reiterate that we need to revisit that QII and to make it more implementable. One of the things that comes to mind is you can't have any structural steel and do QII, well, if you look at today's housing, there's structural steel and we want them to have QII, so if you automatically disqualify them, why are we doing that? Why don't we fix it and find a way to make them work? If you have more than an eighth inch depression anywhere, in any of the insulation in the building, you just get disqualified from QII. I find that kind of hard to believe, but most contractors don't have that level of skill. So, things like that, I know there's an intent. RESNET has done some fairly good work on Grade 1 insulation and have some kind of uniform quality standards, and I'm not saying – we should at least review them and look at them, and make them, I think, more practical and implementable. Because right now the way

QII is written, and the forms that you have to fill out, really discourages that practice. And in this package, if we're looking at 3B, we want to encourage that practice rather than discourage it.

The other issue, which I'm very sensitive to is the mechanical design issue. I mean, the whole thing that we're doing is trying to reduce peak load. Peak load is Air Conditioning load. And what we really want to do is talk about not only our requirements for JD&S which are not only in your Code, but also in the Green Building Code, but how to do right sizing correctly, and how to protect the liability of the mechanical designer, as well as the HVAC subcontractor if they put in a correctly sized system. And we've had these discussions at the beginning of some of the workshops, I haven't seen them float up to the discussion level again and I just wanted to refresh staff that I would like to talk about those and, as an industry group, I think we should involve the HVAC subcontractors also.

MR. SHIRAKH: I actually did talk to one of our attorneys recently about this, I think I'll talk to you offline about it.

MR. HODGSON: Okay, that would be great because I think it's a fairly open discussion and it's really the intent of what the Commission is trying to do with their

Building Standards as we relate to TDV instead of just annual consumption, so the more we can encourage this practice, I think, the better. Thank you.

MR. SHIRAKH: Thank you, Mike. Sir.

MR. VARVAIS: I'm Dan Varvais with Bayer Material Science and today I'm here representing the Spray Foam Alliance, and we'll provide our comments in writing by the August 12th deadline.

MR. SHIRAKH: Please.

MR. VARVAIS: I do have a question, though, on the proposal to increase the insulation value of air permeable insulation, but then not to inspect it to verify that the increases you're shooting for to improve the U Value is met because you're not inspecting for it with QII.

MR. WILCOX: I don't think –-

MR. VARVAIS: You increased the R Value from the 2008 Standards to R15 and R21, but now you're not inspecting it to make sure that it's installed properly.

MR. WILCOX: I'm not sure how you derived that conclusion.

MR. VARVAIS: It says no QII is required.

MS. BROOK: Yeah, one of our packages –

MR. WILCOX: Yeah, one of our packages --

MR. VARVAIS: The staff requirement says QIIs

installed.

MR. SHIRAKH: You have two staff packages and one of them has QII in it and one doesn't. But look, from what we're hearing is, QII is where we're going to land, requiring QII.

MR. VARVAIS: Requiring QII still?

MR. SHIRAKH: I think it's very likely that QII will be in the proscriptive package, rather than ACH50.

MR. VARVAIS: Okay, thank you.

MR. HODGSON: Mike Hodgson again, Con-Sol. Since we're talking spray foam, real quickly, realize that spray foam's packages were not included in QII originally, and we need to accelerate that so that they can be part of QII and I'm sure that's part of your workload, but you know, we can have spray foam, but if we don't allow it to qualify for QII, which currently it's not, then it doesn't make sense.

MR. SHIRAKH: I mean, I think what we need to do is, if you're going that way fairly soon, the next few weeks, we should sit down and look at the QII language.

MR. HODGSON: All right.

MR. SHIRAKH: At the same time, try to make it more user-friendly and –

MR. HODGSON: And expand it for multiple installation types.

MR. SHIRAKH: When we have more experience with it, we have an opportunity to revise the language.

MR. HODGSON: That's great.

MR. SHIRAKH: Mr. Splitt?

MR. SPLITT: It's Pat Splitt from App-Tech, just a couple of clarifications. It was mentioned that you're going to require a minimum attic ventilation. By that, does that mean it's also the maximum? But can we -– by "require," exactly what do you mean?

MR. WILCOX: We're going to basically not require anything for attic insulation, we're going to assume that the house meets the minimum Building Code requirement.

MR. SPLITT: I meant ventilation.

MR. WILCOX: I'm sorry, I meant ventilation, yes.

MR. SPLITT: Okay.

MR. WILCOX: I think a corollary to that is to say that we're not going to give credit for attic ventilation either, which is a change from the current 2008 Standards.

MR. SPLITT: Okay. And for the insulation on the exterior, the sheathing, is there going to be a definition of how that has to be done and how extensive? It seems like that's not included in QII, but, say, are we just, when we get to window and door penetrations, are those framing numbers also going to have to be covered by

the sheathing or not? Has that been determined?

MR. WILCOX: We haven't talked about any details of that. If you think there's an issue there that should be covered, you should propose what it is and how to do it.

MR. SPLITT: Okay. Then I noticed, just looking at the various climate zones and the way the numbers were coming up, it's apparent that the algorithms are different in this calculation than what we have now because things aren't coming out in the Climate Zones the way they do now.

MS. BROOK: I'm not sure that's algorithms, it might be that there is new weather data and also changes in the TDV.

MR. SPLITT: Okay.

MS. BROOK: And then, I mean, it's probably all three, to be honest with you.

MR. SPLITT: Just, that's one example, in Climate Zone 16, the SHGC of .25, you know, right now I wouldn't have thought that that would work out. Assuming that the new calculation says it's really true, then I just want to make sure that, for people who basically are building a ski chalet, that they can still put in their high solar gain glass and somehow, in the algorithms in the performance method, be able to accurately calculate the

solar gain vs. thermal mass to trade off against not having the .25 as HGC.

MS. BROOK: I think we're doing a much better job of that.

MR. WILCOX: I think that's still there. The big change in Climate Zone 16 has to do with the weather in that –- we for many years have used Mount Shasta as the weather file location for Climate Zone 16 and we decided to change, with the new weather files that were available, there were actually, I think, eight options in Climate Zone 16. So, we moved to a much more central, more representative location, which is due east of here up on Highway 80, Blue Canyon.

MR. SPLITT: Okay.

MR. WILCOX: And it has more cooling than we had previously.

MR. SPLITT: All right. So I just wanted to be sure, not just for 16, but for all the climate zones, that we will be able to model passive solar and tradeoffs between thermal mass and more glazing area, or higher SHGC, so we can do passive solar.

MR. WILCOX: Well, you know, the current direction is to be able to do that modeling at about the same level of detail as you can now, and I think the results are much more accurate and solid than they used

to be, and so the results may turn out different, but –

MR. SPLITT: But we can model it.

MR. WILCOX: You can model it.

MR. SPLITT: Okay. Then the final comment is just about the QII. It seems to me that that should be a mandatory feature because the QII requirements are basically what the Manufacturer Representative organizations say you're supposed to be doing it. So I can't see why we don't make it a mandatory feature, not proscriptive, and then verify it not with the special HERS report, but make it part of the installation certificate for the installer. So that's my suggestion.

MR. SHIRAKH: I mean, it's an option, typically we go from Compliance Option to Proscription, then to mandatory, I mean, it's rare where we go directly, but we have to have that discussion. It's going to be hard to trade that off anyways because it's such a big portion of the savings if you put it in there, so essentially it'll be mandatory whether it is proscriptive or not. But we can have that discussion.

MR. SPLITT: Okay.

MR. SHIRAKH: Thank you. I know this is an important topic, this is kind of like the culmination of everything that was done, but we're also running a little bit late. Are there any other comments on the Package A

presentation? Anybody online?

MR. WARE: Yes, there are questions online.

MR. SHIRAKH: Okay.

MR. DEVITO: Eric DeVito. Sorry, my name is Eric DeVito, I'm with BBRS, I represent Cardinal Glass. I've been online this whole time and I originally raised my hand because I had a question on something Bruce Wilcox presented, but that's since been answered. However, while I was online and in the queue, I'd like to respond to a couple things that Mr. Hodgson discussed with regard to the SHGC.

Just a quick background on Cardinal, a very large residential glass manufacturer, makes insulated glass units and coated glass products, and many of you probably heard of us, but we have a presence in California, two plants, and over 30 facilities across the country. But the glass, to meet the .25 SHGC, is readily available not just by us, but by four other glass manufacturers in all.

Just last night, I pulled some manufacturer data from four different manufacturers. The product is readily available, at least they provide it. Whether it is filtered in through all the stores in California, you know, you guys would know better than I would on that, but the product is definitely available. If you just look at, you know, one of the toughest products to me

would be a picture window, a fixed frame picture window, which usually has the smallest profile frame, and several of these manufacturers I was just discussing have picture window products that can meet the .25 SHGC.

Just in 2009, which is a couple years data, dated over 50 percent of the products with NFRC ratings could meet the .25 SHGC, so it's out there, it's available, and it will filter through particularly as the standard comes through. The IEC in 2009 had moved already to the .3 SHGC, the one that Mr. Hodgson had recommended here, so by going to a .3 SHGC only in California, it would be equivalent to the 2009, and since then, 2012 has already moved to the .25 SHGC, at least through Climate Zone 3, which does cover a lot of California.

So, if you had to pick, you know, window values, I commend the staff and folks like Bruce and Ken have done the runs to show the .32 and .25 because those are the very good high water marks to set for the windows that are most appropriate for most of California. So I would encourage you to keep those numbers and I also would reiterate that they are available. I will put one caveat on that, my comments are related to windows, I know there are some issues with skylights and some exceptions you might need to address with regards to those, and I'm not speaking to skylights at the moment, I

am speaking towards the window issue.

So I wanted to make sure, if I did nothing else while I was participating online here, to leave you with the notion that the .25 is achievable, it's feasible, it's available, and it is the right number to set for California. Thanks.

MS. BROOK: Thank you.

MR. SHIRAKH: Thank you, appreciate it. One thing we can do if we're going to continue this discussion, we can move the Zone Air Credit to after lunch. Are people okay with that? Any other questions online?

MR. WARE: Yeah, Ryan Ware, WebEx Operator. A message from Chris Decareau, I apologize about the pronunciation: "Will 2013 incorporate explicit air barrier requirements vs. air sealing?"

MR. WILCOX: The proposal for providing ACH50 criteria also included eliminating the specific air barrier requirements because they're redundant with testing approach. And I think the intention here would be to carry through with that, even if the ACH50 was only a compliance option.

MR. SHIRAKH: Any other questions online?

MR. WARE: Yeah: "Will 2013 incorporate explicit air barrier requirements from ASHRAE 90.1 proposed vs.

air sealing?

MS. BROOK: Yeah, I think we're still studying that, we have a little work scope underway to look at air sealing for non-residential buildings, so we haven't made a determination on that yet.

MR. WARE: Message from Wendy Ong: "Will we update open cell spray foam to qualify it to take QII credit?"

MR. SHIRAKH: I think we just – Mr. Hodgson talked about that and, yes, we'll be looking at revising the language. George, you need to come up.

MR. NESBITT: I believe Monday the 25th is a workshop on QII and load and city spray foam.

MR. SHIRAKH: And I think – Dave Ware, are you going to be there?

MR. WARE: Yes.

MR. SHIRAKH: Okay, thank you. He said yes. The 28th, I believe, is on indoor air quality. Any other questions online?

MR. WARE: No further questions.

MR. SHIRAKH: No other further questions on this one. Again, my suggestion is just to cover the mandatory measures, then break for lunch, and then come back and start with Zone Air Conditioning, and after that Bruce is going to present. And this next topic shouldn't take

very long.

MR. WILCOX: Okay, so the topic here is changes to be made to the Mandatory Requirements for Ceiling, Wall, Floor, Fenestration, and Ducts. So, these requirements are located in the Standards Section 150, which is titled “Mandatory Features and Devices.” So, we’ve spent all morning here talking about what we call the Proscriptive Requirements and, as I had said to begin with, in California that means something that’s different than maybe people in the rest of the country think of when you say “proscriptive.” But there is also a parallel set of requirements in Section 150, which are much closer to what people would normally call “proscriptive.”

And so what the mandatory requirements are, are the absolute minimum levels of measured performance that you have to provide, regardless of the results of your performance calculations, or tradeoff calculations, or computer simulations, however you want to look at it. The California Standards are fundamentally a performance standard and, so, it’s the overall performance of the building that counts. But in order to prevent egregious errors and misallocation of resources, and so forth, there is a back-up level of mandatory requirements that are independent of the performance standard, and that’s

what we're talking about here.

So what's been proposed are changes to insulation requirements, so these are minimum mandatory requirements that you basically can't trade away and go below these requirements, and so the minimum insulation R Value, mandatory for ceilings, in the 2008 standard is R19, and the proposal here is to change that to R30. For walls it's been R13 in 2008, and the proposal is to change it to R15. Raised floor is proposed to be changed from R13 to R19. And for ducts and unconditioned space, the proposal is to change it from R4.2 to R6. So these are the requirements that, as I said, are the minimum mandatory, can't tradeoff below this level of performance.

One of the things to understand here is what it means to have to comply with a minimum R30 ceiling insulation, for example, and the way the Standards are written, there are three different provisions there. The basic one is that, if it says "R30," then you install R30 in all the cavities between all the wood framing. So that's the simplest way to describe it – wherever you've got insulation, it's the minimum R Value, or better.

The second, well, it shouldn't say "walls" here, but anyway, the second option here is you provide an equivalent U Factor -– I copied this out of one section--

you provide an equivalent U Factor in all those surfaces, so ceilings, walls, floors, whatever it is, that you would have had if you had the minimum requirement in between the wood framing. So this allows you to do advanced framing with the different framing factor, it allows you to put sheathing -– insulated sheathing -– on the inside, the outside, or anywhere you want, and use all kinds of alternative systems.

And then the third here, number two, the third option, is you can do an Area Weighted U Factor for all of the surfaces in this category that shows that it's less than or equal to the equivalent U Factor. So, you can even go further, you don't actually have to have R30 in all the surfaces, some of them could be R19 if some of them are R49 and the weighted equivalent U Factor comes out to be what it would have been with R30. So, just to be clear what we're talking about here. This is part of the simplification move -- I would say "not," but anyway…. So what I just showed you is the current language in the standards now, there's not a change in that.

Okay, so another minimum that's proposed here is for Fenestration U Factor, and the proposal is that Fenestration products must have a U Factor less than or equal .57. You just saw the Proscriptive Package

proposed U Factor of .32, so .57 is twice -– almost twice as high, it’s significantly less conserving window and I think the idea here is that you could still do almost any double-glazed window is what will comply with this.

MR. SHIRAKH: Aluminum frame.

MR. WILCOX: Aluminum frame, double-glazed will meet this requirement is the idea. And you can also meet this requirement by the weighted average U Factor, so you could have some windows that were better and some that were worse, as long as the total is less than .57, so that would allow you to even have mixes of single-glazed and high performance windows if you wanted to do that. And then there’s the exception which is basically the Option 3 here, which says that you can exclude eight square feet of fenestration area from the calculation entirely, so you can put in your 2’ X 4’ stained glass single-glaze lead window with, you know, not even included in the calculation, then you’re okay. All right, so that’s the proposed new mandatory fenestration U Factor requirement. That’s it, basically.

MR. SHIRAKH: Any comments on this presentation?

MR. BACCHUS: Jamy Bacchus, NRDC. What was the reason, Bruce, for the tradeoff option if you –- I’m sorry -- why the exception for the previous, let’s say, leaded glass window, or something, when you’ve already

got a tradeoff built in on the previous exemption?

MR. SHIRAKH: Just basically for compliance and enforcement, somebody is doing a small project, you know, just let it be done.

MR. WILCOX: Partly, I think, in the alterations and additions world, if you've bought a window that was stolen from the Chartres Cathedral and you want to install it in your house, and you're not doing anything else --

MR. BACCHUS: That's an unlabeled product.

Mr. SHIRAKH: A lot of these are coming from Building Departments, you know, they're trying to move along projects that are fairly small in scope and they don't want onerous forms and calculations, so --

MR. BACCHUS: Is there something behind the eight square feet? Or arbitrary?

MR. SHIRAKH: They seem to be asking the same questions, so -– not a huge amount of glass, they're only 2' X 4'. And, again, this is just mandatory measures they still have to meet the overall budget for the building, which includes, you know, all the glass and based on the proscriptive requirements that are far more stringent. Mike.

MR. GABLE: Mike Gable. So, what are you guys going to do about modifying that, or an exception to that

for greenhouse, garden windows and skylights? It seems to me that you have to kind of make some accommodation for those because --

MR. SHIRAKH: This .57 does not apply to skylights, it's only for --

MR. GABLE: Well, what about greenhouse, garden windows, as well, also?

Mr. SHIRAKH: So are they going to have a problem meeting the .57 U Factor?

MR. GABLE: Just looking at the default table, 116, you know, you just might want to take a look at that and think about it.

MR. SHIRAKH: Okay, well, I mean, if you think there's a problem, let us know, but we didn't think there should be a problem meeting that U Factor and we don't have SHEC in there.

MR. GABLE: Yeah, I'm just looking at the default table and so --

MR. SHIRAKH: The default table is based on what's the worst of the worst, and then some.

MR. GABLE: Right, but I think if you look at that, I think the greenhouse garden window is substantially higher than .57.

MR. SHIRAKH: Yeah, but, again, those are default, I think the actual products we need to look at,

I mean --

MR. GABLE: Right, I'm just –

MR. SHIRAKH: -- I'm not saying it's not a problem, but I wouldn't go by default because default is the worst.

MR. GABLE: Okay.

MR. SHIRAKH: Nelson, do you want to comment on that – George, can Nelson respond to that?

MR. NESBITT: George Nesbitt -– oh, sorry.

MR. PENA: Nelson Pena, CEC staff. We have not looked at the default version of the greenhouse, we thought those values were, as Mazi has said, those were the worst case of the worst, so we're going to leave those alone. As far as NFRC listing greenhouses, there are plenty available, I think I counted less than 10, but they do meet the efficiency standard requirement as listed in the NFRC Product Directory List.

MR. SHIRAKH: So, Nelson, if you can, verify that and we can communicate that to Mike, that would be good.

MR. PENA: Okay.

MR. SHIRAKH: And we don't have NESHC requirements in here specifically with greenhouse windows in mind. George. Thank you, Nelson.

MR. NESBITT: George Nesbitt. Yeah, the .57 looks fine. I think on skylights, as long as – I think

with skylights, there are, like Velux has an aluminum curve mount skylight which has an internal vinyl frame, and I believe other smaller manufacturers have them and should be able to make them, and I imagine that should get below that. You know, so as long as that would fall under that, I would say we shouldn't exempt skylights, if we can get rid of just the plain curve mount aluminum skylights, that would be a good thing.

On the Insulation Mandatory Measures, I think that's basically all fine for new construction. On existing, we may want to think about whether -- I mean, it's not always possible, or it's harder, and I think the one perhaps clarification would be that you don't take that R30 batt and slam it into a 2' X 4' or 2' X 6', I mean, that's obviously not the intent, but in R30 fiberglass, say, in a fiberglass batt is a high density batt in a 2' X 10' or a low density batt in a 2' X 12', so if you want to go to the Exception language, the next slide, I don't know -- did you say these were current exemptions, still?

MR. SHIRAKH: The exceptions are not new.

MR. NESBITT: Yeah. Perhaps 1A really needs to be reworded that the required R Value is installed in a framing – in the appropriate framing, so when you go to the Appendix, look up that you don't -- there is no R30

for a 2’ X 8’ in the Appendix lookup because you can’t do it without compressing the batt, and you no longer have an R30. So, I think that would be perhaps one clarity that maybe we need to say the R Value is installed in the assembly, that it has to be installed in the assembly in the Appendix lookup, or that meets that same equivalent U Value because we do see plenty of that smashed in places they shouldn’t be, so that would be, like I say, the only existing alteration, and the question will be whether some of those levels are hard at times.

MR. SHIRAKH: Pat.

MR. SPLITT: Pat with App-Tech, just one comment. I’m from Santa Cruz and we have a lot of Victorian houses there, so when they’re going to put in an addition, or do some remodeling, especially in front of the building, what they want to do, first, they want to be green, so they want to re-use the existing fancy windows they have, which may be single pane, and not throw them away because there’s no way of finding a window that’s going to match all their other windows, that’s going to have all the features they want. So, for instances like that, I’d like to come up with some sort of more simplified way of trading off keeping that window by saying, well, if on the back of the house we just exchange an equivalent square footage of existing glass that meets the standard,

without having to remodel the entire house, to do a weighted average of all the windows.

MR. SHIRAKH: Okay, I think as part of this discussion, we're going to relate it to alterations, I think and we can address this.

MR. HUDGSON: Mike Hudgson, Con-Sol. Real quickly, a minimum mandatory insulation in the ceiling going from 19 to 30, so we're going to go from 2' X 6' to 2' X 10' potential rafters as a minimum, right? In a sloped ceiling. So that's one of the things that you are recommending. The other is, does this minimum mandatory also apply, then, to retrofits? Or renovations?

MR. SHIRAKH: Well, again, that will be part of this discussion we're going to have. But, at the moment, it would, not unless we exempt it.

MR. HODGSON: Okay, and I think that's an issue, you know, if you're not changing out your roof or your ceiling members, and you're trying to do something similar, what we may have to do is put a batt in a foam on top of it, which we have issues with that potentially, too, right? So I'm just concerned about changing that in the rafter portion, the ceiling portion, or attic portion, if we've got room, it's not a problem, but where there's no room, changing out structural members, you know, remodel is pretty costly.

MR. SHIRAKH: Bruce had the same concerns, actually.

MR. WILCOX: Actually, John Proctor pointed out that the staff proposal was to make the air flow and fan watts requirement for Air Conditioning systems mandatory, and it somehow didn't get into this presentation. That doesn't mean that it's not being proposed. And it doesn't go in Section 150, it goes somewhere else, so that's why we didn't get it in here now. So -- no, this is getting in here before lunch! That is still proposed. It was, in fact, in all the package stuff we showed you earlier.

MR. SHIRAKH: It is a proscriptive requirement, now the proposal is to make it mandatory. We can have a discussion about that.

Any other comments on –

MR. VARVAIS: Dan Varvais with SBFA. We'll provide comments by August 12th.

MR. SHIRAKH: Thank you. I appreciate it. So any other questions online?

MR. DEVITO: Eric DeVito again, BBRS, representing Cardinal Glass. Real brief, we will be providing some written comments, but I understand, you know what Bruce explained, how the U Factor cap for the windows is setting it at .57 and, you know, really it

seems the goal was to allow a lot of the products that are currently being used to still be used. I just draw some comparisons to the IECC again. Since 2004, in fact, the IECC has had these type of mandatory measures, which we refer to as caps, the U Factor cap in IECC's Zones 4 through 5 is .48, they also have an SHGC cap in Zones 1 through 3 of .5. The reasons they adopted these caps, which are for comfort, condensation reasons and others, you know, I know there is – you all have specific reasons why you're proposing what you're proposing and I'm not going to certainly – like I said, I'll provide written comments to that effect, but I would ask you to at least consider, you know, if you're going to have these caps, to fashion them in maybe a slightly different way and maybe exempt some of the things that you are concerned about, like passive solar design and greenhouses and skylights, of course, but with the goal of focusing on the residential punched opening window that you're going to put in, you know, do you really want to be allowing clear glass in certain situations. And, again, for comfort and condensation reasons, you've had a .4 U Factor, .4 SHGC, in your proscriptive package for many years. The next step would obviously be trying to prevent any backsliding from those types of windows. So, I would just ask the Commission to look at it, if there

is any way to ratchet down the caps a little further. Thanks.

MR. SHIRAKH: So this is Mazi Shirakh, CEC staff. Can you –- I'm really interested in the interaction with the passive solar design. Now, we don't have a SHGC requirement specifically for that reason.

MR. DEVITO: Right.

MR. SHIRAKH: Why would the U Factor be a consideration?

MR. DEVITO: It wouldn't. I was suggesting you consider an SHGC cap and then if you wanted to protect the passage of solar design, then you work up some type of exemption for it.

MR. SHIRAKH: So can you include those in your written comments to us, please?

MR. DEVITO: Sure.

MR. SHIRAKH: Appreciate it. Any other comments online? So why don't we meet back here at 1:00? And we'll start with the Zone Air Conditioning.

(Recess at 11:52 a.m.)

(Reconvene at 1:07 p.m.)

MR. SHIRAKH: Okay, we're good. So we're going to start with the item that was left behind from this morning, the Zone Air Conditioning, and Bruce is going to present that.

MR. WILCOX: Thank you, Mazi, this is a topic called Residential Zoned Air Conditioning and so the background on this is that this was a proposal that was sponsored by the California Statewide Utility Codes and Standards Program, it's what they call a "Codes and Standards Enhancement" or "Case Study," and the study authors were myself, John Proctor, and Rich Chitwood. John Proctor is here and can help in terms of answering questions and so forth.

So, we're going to talk about what the current Code requirements are for zone air conditioning, zoned air conditioning, typical practice, we're going to summarize our Code change proposals, we'll talk about research data and findings from that, and then we'll talk about the Code change proposals in detail. One of the things I like to sort of make clear, just before we start here, is that the purpose of this proposal, all the analysis and work that was done here was not to try and prohibit zone control systems for air conditioning. The purpose was to ensure that zonal systems operate with energy efficiency that is equal to non-zone air conditioning systems, just a very simple concept that zone control systems should be equally efficient with their single zone counterparts.

There are several aspects to this proposal that

we'll talk about, but there are basically three major areas we're going to talk about: bypass ducts and how they work and what they do, I want to talk about air flow and fan watts related to air conditioning, getting the supply air that goes through the cooling coils to the house, and then we're going to talk about the performance credit in the current standards for zonal systems.

Okay, so the current Code requirements in California related to this subject is that there is a proscriptive requirement in the 2008 Standards that says that you need to demonstrate that you have 350 CFM per ton in every zonal mode and meet the fan watt requirements. That's a proscriptive requirement and it's only in the hottest climate zones, and since it's not mandatory, that can be traded away and so it's not as universally applied.

There is also a performance credit for zonal systems that's been implemented in the simulation performance method as a set of alternate heating and cooling set points, that make it -– basically, the cooling set point is higher in zones during different parts of the day and the heating set point is lower than it is for single zone systems, which means that you don't need as much calculated energy to maintain those set points, and that results in a compliance performance

credit.

There is some requirements specific to that credit. You have to have a return duct, a return register in each zone, you can't have more than 40 square feet of uncontrolled opening between the zones, and you can't have any measurable air flow at registers in any location except the zones that are calling for air conditioning. So you have to have a very well controlled system in order to comply with this performance credit.

Our understanding is that it's not often used, partly for the reason that it's difficult to meet all these requirements. There are no restrictions on variable capacity, or control type, or number of units, or commissioning, or anything related to the zoning systems, specifically, other than the above.

And one of the other sort of contextual things going on here is that the California standards require mandatory setback thermostats in all their new houses regardless of whether it's a zoned system or not, so there is already an assumption that there will be heating and cooling setbacks and those are built into the analysis assumptions that are being built for normal systems in meeting the Code.

So the typical practice for zonal air conditioning systems, there are two types that are common

and you see in California, the first type is where you have multiple separate systems, generally one in each zone, and a typical example might be a two-story house where there is a system to supply the bedroom zone upstairs and a separate system to supply the living zones downstairs. They have their own thermostat and they have their own duct systems, and they basically operate as two separate split systems. These systems generally perform pretty well and have a higher cost. The other system is where you have a single system with a single air handler and outdoor unit and you put dampers in a system of supply ducts so you can turn the air supply on or off to zone since the thermostats are calling for heating or cooling. Typically, return ducts are not zoned, either there is no dampers on the return side, so you're always pulling return air from the same place, regardless of whether the zones are calling for conditioning or not.

Typically in California we see single speed compressors and fans that can't modulate to track the load. Supply air flow is low, even with all the zones calling; this is typical of California systems, in general, but we find that the situation is worse in zonal systems and we'll show you some data on that. And there are bypass ducts in many of these systems, and a bypass duct being a short circuit from the supply duct side of

the system to the return. And we'll talk about them in a few minutes, as well. The results of this is a low EER, Energy Efficiency Ratio, in other words, a low efficiency at delivering cooling to the house compared to the electric inputs to the air conditioning system.

So what we're proposing here is a mandatory requirement to eliminate bypass ducts or not to allow bypass ducts in zonal systems, particularly air conditioning systems. A second change is to delete the current zonal air conditioning performance compliance credit, in other words, not allow an easier set of heating or cooling set points if you claim zonal air conditioning, and to require air flow and fan watt verification in all cooling, in all zonal cooling modes. And by the way, this is a mandatory requirement that is proposed to apply also to all single zone systems, so it's just an attempt to make sure that the zonal systems work equally well with the normal single -– what we expect of a normal single zone system.

We did a bunch of work and produced a field survey, a project called the California New Home Energy Survey, and we did a field survey of a sample of 80 new 2007 California homes and found in relation to this topic that air conditioning systems generally have a load capacity of efficiency, that cooling duct pressures are

very high, the cooling fan watts are very high, and generally that the systems aren't working all that well.

One of the interesting things, what is the makeup of the systems you find in new California houses, of the 80 systems that we looked at, 12 percent of them were dampered multi-zoned systems, the kind of thing we're talking about here. So this is a significant part of the market, and this shows the range of all the other stuff that we found. There were also the multiple split system approach, there were 17 of those. So we're talking a significant fraction of all the new homes are doing one sort or another of a zonal air conditioning system.

So the results from that survey show that damper multi-zone systems have low CFM per ton and high cooling fan power per CFM. So, if you look at this upper left graph here, this is air flow in cubic feet per minute per nominal ton of air conditioner capacity and these are the average values, it's the blue striped bar, and the maximum values are the blue solid bar, of all the 80 systems that we looked at in the survey. For single zoned systems, the average was about 340 CFM per ton with multi-zone operating with all the zones calling, the average was 280, roughly, CFM per ton, so significantly less. And then, if you operate the zonal system with only one calling, the airflows is lower yet and it's down

at 250 CFM per ton. So, the zonal operation of these typical systems affects the cooling air flow significantly, based on this data. And then the fan watts is –-

MR. SHIRAKH: Do you have a question, Jamy? Can you pick up your voice?

MR. BACCHUS: Jamy Bacchus, NRDC. What did you mean by “low capacity?” Is that related to the nominal capacity of the actual units installed? Or the actual delivery of cooling?

MR. WILCOX: No, if you have a four-ton system and, you know, the nominal -- a four-ton system is 48,000 Btus of cooling total capacity, nominally, and we often find that the real capability of the system to deliver cooling to the space is much less than that. And so, if you had a four-ton system that only was capable of delivering two tons of cooling, that’s what we mean by low capacity.

MR. BACCHUS: [Inaudible] the reduction in capacity based on its nominal [inaudible]

MR. WILCOX: I think you might have to come up to the front because I can’t hear you, let alone –

MR. SHIRAKH: If we can’t hear you, he can’t hear you.

MR. BACCHUS: I think you’re just saying that the

capacity of the unit, the manufacturer's rated capacity, the nominal capacity, whatever it might be, is not what you're actually getting out of it. You're getting reduced capacity --

MR. WILCOX: That's correct.

MR. BACCHUS: -- not that their unit is not right sized to the load, or under-delivering cooling.

MR. WILCOX: No, it doesn't have anything to do with sizing, it has to do with the output of the system compared to what you would expect it to be.

And then, on the lower right-hand plot here is the fan power consumed by the furnace fan of these split systems in terms of watts per CFM of air flow and cooling mode, and the single zone systems, the fan watts on average, is about a little over half a watt per CFM and, in multi-zone systems, on average, even if all the zones are calling, delivering air to all the zones simultaneously, the average air flow is about .75, not the average air flow, the average watts per CFM is about .75, and in the average case where you're doing multi-zone with one zone calling, the fan watts to deliver CFM to the zones is about .8 watts per CFM on average, so there is a significant difference between single zone systems and multi-zone systems in both the amount of air that they're delivering and the amount of power they take

to deliver that air, so that's part of the context here.

So this is a little diagram of a typical dampered multi-zone air conditioning system, or the bypass duct. So the box here in the upper middle is the furnace with its cooling coil and its fan that blows the air through the house, and then you have a return register that takes air from the house, and it goes into the furnace, then that blows the air out and it can go to, in this case, zone 1 if this damper is open, and zone 2 if that damper is open, and the bypass duct runs from the supply right around here and goes back into the return. And the way, if only zone 1 is open, then typically part of the air goes through the bypass duct, instead of going to the house, it goes through the bypass duct and back around into the furnace again. So this is a damper multi-zone air conditioning system with a bypass duct.

So how does this thing work? How does this bypass duct work? So, in theory, when all zones are calling, like in the previous example, if both those zones, the thermostat is requiring cooling, then the bypass damper closes and the bypass has no effect because all the air goes to the zone just like it would if it was a single zone system, and all the zones get the design air flow. When only one zone calls, whatever isn't delivered to that zone is bypassed to the return to

maintain the cooling coil air flow, and also to avoid increased air velocity of noise that you would get if you put all that air into one zone.

Actually, in our opinion, what happens here is that, when you mix the bypass air that comes back into the return duct, you're lowering the return air temperature that enters the cooling coil, and this always significantly lowers the energy efficiency ratio of the air conditioner. This is the absolute physics of the situation that the air conditioner efficiency depends on the temperature of the return air, and the bypass duct is always going to lower that and cause the EER to go down.

And then, in addition, because the dampers and the duct design that typically ends up, the air flow is typically low even when all the zones are calling, you have more fittings and more dampers and more restrictions, and so forth. And then, in addition, because of those extra dampers and ducts, systems are more prone to construction failure, construction errors, these are very common, and because the duct system is bigger, you get bigger duct losses, as well. So, just so you know, we've seen these things. This is a typical California kind of installation where you have the furnace here and the air conditioning system – this is kind of a distorted picture, but that's what's operating

right here, there is the flu from the furnace and you have ducts running around in this hot attic, and this duct right here is the bypass duct for the system, so it runs from the supply plenum over here to the return and cold air comes from the supply, goes over here, and comes back into the return, and goes around and around.

Here is another example in one of the houses we surveyed where there is this 16-inch metal duct here that goes from the return supply over here to the return over here, and you can see the arm here of the gravity damper that is supposed to open and close when the pressure in the duct system changes so that the air can go back around in the bypass.

Okay, so one of the things we wanted to acknowledge is the comments from some stakeholders based on our case presentations. The Air Conditioning Contractors of America and the American Heating and Refrigeration Institute, AHARI, both commented that they want to maintain the current credit for zone systems and have argued that, in some cases, there is energy savings, and they want to maintain the use of the bypass duct.

There has been some research presented on damper multi-zone systems, well, these are two papers, I think they're related to maybe the same experiments that were done at the National Association of Homebuilders Research

Center, sponsored by NAHB and Carrier and, you know, we've looked at those studies and there's some interesting conclusions in there, one is quoted here, it says that "studies have demonstrated that a multi-zone system will use more energy than a central thermostat system when a constant set point is used." "And a 35 percent increase was documented as a direct result of multi-zone systems being more responsive to the cooling needs of the entire house." So, you know, the research indicates that, at least in some cases, you put in a multi-zone system and the energy use goes up.

There's an ASHRAE paper which says that zoning with no thermostat set up uses more electricity for cooling than the system in a central configuration with no thermostat sub point scheduling. And, again, part of the reason is that you're getting better temperature control and the unit is responding to the loads in the house better and using more energy to do that.

So one of the things that we attempted to do as part of this project was we made a model of a zoned air conditioning system with the kind of characteristics here that you find in California houses, and tried to look at how much impact the zoning system would have on the efficiency. And this is a theoretical model that we're showing here, and what's plotted on here is the results

from this model and, on the left-hand side, what we have is the Net Sensible EER and its' in percentage terms and it's relative to the rate of value at 350 CFM per ton and no bypass, so this is just saying what's the relative performance of the system compared to its rating. Across the bottom, we have the CFM of air delivered to the condition space and, again, relative to the rated values at 350 CFM per ton, and the various lines here show the combination of different percentages of bypass and of total system air flow to the zone. So, up here at the upper right-hand corner, where we have no percent of air that goes through the bypass ducts, we have 100 percent air flow to the zone and we have, at that point, we get 100 percent of the rated EER. So, this is what the nominal system would do is right here. So, if you take that line with no bypass, and just follow it across here, what it's saying is that, if you reduce the air flow through the system by just putting in more restriction or turning the fan down, or whatever it is to get the air flow to be less than, but then you get down to 50 percent air flow, which is the 175 CFM per ton, then you are about 83 percent of the nominal EER. So the system efficiency is 17 percent lower than rated when you cut the air flow down. And then these additional lines here are looking at the combined effect of that plus different

percentages of air that goes through the bypass duct. So, for example, this line down here is 50 percent of the air is going through the bypass duct and the total air flow to the zone is 50 percent, and at 50 percent you're now down at efficiency is 77 percent of what you would expect for the nominal system and its rating.

And we're doing this in terms of Sensible EER, which is –- we think it makes sense in California climates where we're not really all that interested in dehumidifying most of the time and we're really looking for big cooling capacity when it's very hot outside and typically dry, so that's the reason for Sensible EER.

So this is what the theoretical model – this model is derived from Standard Air Conditioning Manufacturers Extended Data Tables. You can look for most residential equipment and you'll find the manufacturers' supply of data that you would need, and that we used to plot this result.

So the other thing we did is we went out and measured the detailed operation of zone systems in three houses that we surveyed in that field survey. Each one of these houses, we spent a whole day with a crew of people and measured the Net Sensible EER of the zone systems based on measuring – it's the tons at the register approach, you measure the air flow and

temperature of the air at each supply register and the air flow and temperature of the air at the return register, and you can calculate how much cooling was delivered to the space. In this case, we're talking about sensible cooling, and then we manipulated the controls in the systems manually to achieve different levels of bypass and different levels of CFM.

And just to see what the impact would be on our net sensible EER number here, again, same terms, it's percentage of the nominal, and down at the bottom is the percentage of the CFM delivered to the conditioned space. And you can see that, when you're up here at the 100 percent air flow to the space, you know, we're in the neighborhood of 100 percent of the nominal capacity. The dark blue line here is Field Study House No. 3, the gold line is Field Study House No. 2, and the green one is Field Study House No. 1, so we actually did this in three different houses, these three houses, and so what you see is basically similar to what we showed in the last graph, that as you reduce the amount of air flow that goes to the conditioned zones, and increase the bypass, then the EER goes down, and this is at 27 percent bypass, this is at 45 percent, this is at 39, it depends on the –- the details depend on the system and there is lots of interactions between things like how leaky the ducts are,

where they're located, and are you running more air through the ducts in the attic that have the big leaks, or not. These are the systems as found in the field, it's only three houses, but that the results all agree with each other pretty well.

So it's interesting that, if you plot our theoretical model right from the air conditioning manufacturers' data, over the top of this field data, the field data actually shows that the situation is worse than what the manufacturers' data would have indicated, that the percentage lost in Sensible EER is actually bigger. And part of that is because -- we think that part of that is because the manufacturers' data that we're using here is extrapolated and down at these low levels, and they don't actually spend a lot of time testing things, they don't really want people to be operating down here anyway. And plus we're talking about real systems installed in buildings where there are duct losses and so forth, and that's not included in the Manufacturers data. So there's more things operating here than there are in the theoretical model. One of the interesting things that we discovered recently is that there's the Air Conditioning Contractors of America, ACCA, has a new standard that's been out for public review called Manual ZR, there's a reference down here at

the bottom, it's a standard for how to do zoned air conditioning systems for residential low-rise buildings, and we looked at their draft which, as I say, has been out for public review, and it's not a final document. And there's a set of data in there that shows what you would expect – what ACCA thinks you should expect from a zone system where you have certain levels of bypass and certain levels of air flow and, you know, their curve, which is the blue line here. Basically, it matches the field data from our -– we were comparing it to Field Study House No. 2 here, just for example, but it's basically the same pattern. So the stuff we're finding in the field seems to be what the people who know about zone systems would expect you to find.

So a question about why are these bypasses so bad. And kind of as a thought exercise, imagine this system here where you have your furnace and your cooling coil and your fan, and you're taking air and you're blowing it out, and all the air is going through the bypass and back into the return duct, and no air is getting delivered anywhere; so what happens then is that, if you're in heating mode, the temperature very quickly goes up to the outlet temperature of your furnace and, at that point, you can't add anymore heat to the air, well, what actually will happen is it will start running on the

safety switch and turning off the gas valve, but in cooling the temperature drops down, you know, keeps going down colder, colder, colder, until again you end up with the system going off on safety controls, but it gets harder and harder and harder to supply cooling when the air coming back to the system is actually at the temperature you're supposed to be making it with the air conditioning. So this is what's going on with the bypass duct.

So an example of that situation with real measurements that we made in these houses that we studied, this on the left-hand side is the return plenum air temperature, and the dark blue bar is no bypass, the striped middle bar is mild bypass, and then the open bar is maximum bypass, so that the open bar is not 100 percent of the air going back, but the most that we could set this system up to do, which was maybe on the order of 150 percent and look what happens to the return temperature in cooling with the no bypass going to the return temperature air coming essentially back from the house, which was about 78 degrees, which was sort of in the range of what you'd expect, with half the bypass operating, you've got the return temperature down to 68 degrees, and with the maximum bypass, you're getting the air temperature down to 55 or so, so the air entering the

cooling coil is, you know, mid-50's. And here's the cooling capacity, the sensible cooling capacity of the air conditioning system for that same condition, 33,000 Btus in the case with no bypass, 18,000 in the case with the medium bypass, and it drops down when you're running 55 degree air in there, it drops down to 7,000 Btus, so this is another version of reduced capacity, as we've talked about earlier.

And from an efficiency point of view, a simplistic way of looking at this that I find useful is that, for most air conditioning systems, the amount of electricity input to the system is generally pretty much independent of the capacity. An air conditioning system draws -- it's not exactly the same, but about the same amount of electricity, regardless of what's going on here. So you're producing 7,000 Btus of cooling for the same amount of electricity that you could have gotten 32,000 Btus of cooling, so that's the reason it's of concern, I think. Here's a different way of looking at it based on measurement in a different house, this is comparing what would happen based on, you know, we did all these measurements and manipulated the system, figured out what its capacity was, and so forth, and we figured out that if you eliminated the bypass duct, that would increase the sensible efficiency air delivered to

the house by almost 50 percent. If you eliminated the bypass duct and you got the full 350 CFM per ton of air flow, then you're getting the efficiency up 60 percent. And how big a deal is that? Well, that's what happens when you go from 13 to 14, that's an eight percent number, so these efficiency changes, we think, are significant compared to the other things we're doing in the world of efficiency.

So based on our survey study, in typical homes with dampered multi-zone systems in California new homes, we think the air conditioning SER to ER degraded by 17 percent with the systems designed and installed the way they are now. And although the heating impact is much smaller, it's still not zero and we think that's a four percent reduction in AFUE due to the change in the return air temperature, basically.

So how do you improve this situation? How can you get full CFM through the system, not get a lot of noise, etc.? So how do you get rid of that bypass and make the system work? Well, the answer is there are many ways to do that. And we're having little problems here with versions of the Powerpoint, I think, I'm sorry for the format glitches here. One answer is this one, this is a system that people have used successfully where you have the return duct, return register, here's your

handler, and with your cooling coil, and then you go to –- for illustrative purposes here, two zones, and each of those zones has two registers, or two supply ducts with registers, the bonus supply and the regular supply for Zone 1, and bonus supply and regular supply for Zone 2, and the damper is on the bonus supply and, so, when Zone 1 is calling for cooling and Zone 2 is not, you open the damper on the bonus supply on Zone 1 and, for example purposes, two-thirds of the air will go to Zone 1, assuming these were all equal supply, or they wouldn't have to be, but assuming they were, two-thirds of the air would go to Zone 1 and then one-third of the air would go to Zone 2. So you would still be supplying some air to Zone 2, you would be supplying twice as much air and twice as much cooling to Zone 1 in response to its call. The opposite would happen when Zone 2 was calling, and then when both zones were calling at the same time, you close both bonuses and supply the right amount of air to both zones, or you partially close both bonuses, but anyway, using this approach, you can keep basically the same amount of air flow through the system, regardless of whether it's one zone, or two zones, you can have normal register flows through the register so that things really aren't noisy, etc.

And notice there's no bypass here, there is no

bypass damper, no duct, and we think this system for a small two-zone operation is obviously cost-effective in that it's not significantly more equipment than you need for the normal system.

Another answer is you do a system just like this and you set it up so that the zone dampers don't completely close, and you can get basically the same effect that we got in the previous version, so if Zone 2 is not calling for anything, you close the damper so that it only gets one-third of its flow, and then you'll get two-thirds of the flow roughly going through the other zone, and if you set up the duct sizes correctly, you can do this without reducing the air flow in the one zone case. The register flow does change from both zones calling to one zone calling, so it's not as ideal a situation from a register flow and distribution point of view.

So the other answer is this separate system for each zone, where you get a completely separate system that is sized and designed for the correct air flow that operates for upstairs and a separate one for downstairs, and they operate independently. This system is used a lot in California and we think it has lots of advantages. Another operation, or another option moving forward, is probably mini-split system where you have a small split

system in each zone that maybe doesn't even have ducts at all, and that's a way of supplying zonal cooling at high efficiency.

Another way to do this same thing and get a system that can have high efficiency is to use variable capacity equipment, so that if, for example, again, you have your two-zone system and only one zone is calling, if you have a variable speed compressor and a variable speed fan, you can run your compressor at half speed and run the fan at half speed and get the appropriate air flow for the reduced capacity of the system, reduced capacity of the compressor, and actually in many cases that will result in an efficiency increase at part load.

So, our conclusions here are that bypass ducts should be prohibited because they intrinsically reduce energy efficiency. We're very concerned in California standards that, to maintain equipment efficiency, and we have appliance regulations to do that, and we're particularly interest in air conditioning systems because of their peak electricity impact, and bypass ducts, we think the impact is very clear that they reduce the energy efficiency of the system below what the appliance efficiency rating would tell you you're going to get, and below the requirements, in effect, that we're implicitly all thinking that if you are buying a SEER 15 unit that

you're getting a SEER 15 installed in the house and operating, but the evidence is that, with a zone system with bypass ducts, that's not the case.

One of the couple of quotes here, one of which is that multi-zone systems -– well, the conclusion is multi-zone systems are for comfort, not for energy savings. And, you know, the comment is from Glenn Hourahan from ACCA was that properly designed installed multi-zone systems improve comfort. And if they're done right, that's certainly a potential outcome. But do they provide energy savings? That's the other question. And, in fact, we think the multi-zone systems often can actually increase energy consumption. Glenn's comments also say that properly designed systems may or may not save a significant amount of energy or may increase energy use to some extent. So that's part of the context here.

So our proposal specifically is that there be a new mandatory requirement for zone systems. That requirement is now part of the proscriptive air flow option and standard, but it's not a mandatory requirement. And that mandatory requirement would disallow bypass ducts, would require a minimum CFM per ton and a maximum watts per CFM in all of the zone loads, so as part of the commissioning process for the air

conditioning system, the contractor would measure the air flow with Zone 1 calling and the air flow with Zone 2 calling, and the watts, and show that that met the standard, and that would meet this requirement. And then we're also proposing to eliminate this credit that always gets you an energy credit if you claim that you have zoning in the performance method. The way the thermostats are set up, you always use less energy if you claim that credit, and that's because the presumption is that, when you have a zonal system, you will in fact do much more aggressive setbacks, and it's not clear there's any evidence that, in fact, that's what happens, that just because people have a zonal system, they will keep their bedrooms at 83 degrees until 11:00 at night every night in the summertime, thus saving lots of cooling energy. I kind of have my doubts whether that's really going to happen, especially – imagine the houses with the young children upstairs, putting them to bed at 10:00, "Sorry, kids, we can't turn the air conditioning on until 11:00, but it'll be better than." Anyway, that's our proposal and send all the comments to Mazi!

MR. SHIRAKH: And cc Bruce, please. John.

MR. PROCTOR: John Proctor. I'd like to make a correction to what Bruce said. If you go back to the field data, those three curves, any one of those that

show the three curves, that data is not at the house, it's the flow, the flow measured is going to the house, but the temperature drop through the unit is measured at the unit, so it's the same thing that, when you look at the ACCA graph, which I think is a couple slides further, it is looked at the same thing, it's what is happening actually at the unit.

MR. WILCOX: So these two are really comparable?

MR. PROCTOR: Those are comparable.

MR. WILCOX: Yeah, okay.

MR. NESBITT: [Inaudible]

MR. SHIRAKH: George, you should know better by now. You can't yell from -- go ahead, please.

MR. CROUCH: John Crouch with HPBA. We're the vented gas heating fireplace people. Ninety-five percent of all gas fireplaces in the state come through our members. And I know this is about zonal cooling, but we're very concerned that zonal heating will get thrown out with this bathwater, if you will. And I appreciate now seeing the presentation that the focus is on the application of a lot of this in cooling, but zonal heating is very intuitive in homes and is used a little bit in the state in new construction, and we anticipate it'll be used a great deal more in new construction in the coming cycles, and we really want to encourage the

staff to keep attitudes towards zonal heating and zonal cooling separate, and preserve the zonal heating opportunity, especially --

MR. SHIRAKH: What do you mean by “opportunity?” We’re not disallowing it.

MR. CROUCH: I know you’re not and I appreciate that, seeing the presentation is very helpful now, but we are also concerned about the software in the new engine. If the software doesn’t allow -– we hope the software will allow zonal heating and credits for it.

MR. SHIRAKH: But there is a difference between allowing zonal heating or taking credit. What are you talking about?

MR. CROUCH: We are interested in taking credit for it and having it recognized in the software, and we’ll provide more comments.

MR. SHIRAKH: Thank you.

MR. CROUCH: You’re welcome.

MR. HODGSON: Mike Hodgson, Con-Sol, representing CBI. Bruce, I had a question. On your 12 percent ducted system that are dampered, I couldn’t follow the math and so are you saying that 12 percent of the market uses a two-zone approach, or a multi-zone approach?

MR. WILCOX: The multi-zone is a larger fraction of the market than that and, of the systems we surveyed,

12 percent of them were dampered multi-zone systems. Well, actually –- 12 percent are the ones that had ducts. In other words, leaving out the wall furnaces.

MR. HODGSON: So 12 percent of the market – 12 percent of the new construction market in your survey were dampered multi-zone systems? Twelve percent of the new construction market were dampered, multi-zone systems? I'm just trying to understand your math.

MR. PROCTOR: No, this is John Proctor, 12 percent of the ducted systems in the sample were ducted, multi-zone systems, they had ducted damped systems. There are not 80 ducted systems in the sample. Radiant floor systems are not ducted, etc. etc.

MR. HODGSON: Right, so of the 70, or whatever, that had ducts, 12 percent of those have dampers and are multi-zoned?

MR. PROCTOR: That's correct.

MR. HODGSON: Okay.

MR. WILCOX: In addition, there were 17 multiple split systems. There were more, actually, more of the houses we saw that had multiple systems than had damper systems.

MR. HODGSON: And that's where I'm going. My understanding of the market would be that, if you "two-zoned" a house and tried to get credit for it, the

majority of those would actually have two separate systems, living and sleeping, type thing –- upstairs/downstairs, but your proposal is for those systems also not to get a two-zone credit, correct? All right, and the rationale is, on the air conditioning side, you don't see setbacks working in the sleeping zone.

MR. WILCOX: Yeah.

MR. HODGSON: All right.

MR. WILCOX: As far as we can – yes, that's basically it.

MR. HODGSON: Okay, so the concern going forward, not necessarily this Code cycle, but for future Code cycles, we get smaller and smaller, are we still going to have the ability to model those small loads as living and sleeping areas in whatever version of software we have?

MR. WILCOX: You mean with different set points?

MR. HODGSON: Yes.

MR. WILCOX: Well, that depends on what we decide here. If we go ahead with the proposal to eliminate that zonal credit, then I would say not.

MR. HODSON: Okay, so I think the issue for us would be then, not disagreeing with the air conditioning side of it, but on the heating side, I think there is some logic to having separate set points and we don't

want that to go away because we think, in the long terms, as we get smaller and smaller loads, we're going to have smaller and smaller appliances to service those loads, and we think those will be in multiple zones. Okay? Thank you.

MR. SHIRAKH: Thank you, Mike.

MR. KEESEE: Mike Keesee from SMUD. A couple questions and then a personal observation. I'm concerned about the air flow and the setback thermostat requirements in these conditions because, if you look at the mini splits, they have very low air flow. I don't think they achieve the 350 CFM per ton, at least not what I've seen. And the ones I've seen don't come with setback thermostats. Now, of course, that may have changed recently because I have an older unit, but I haven't seen anything coming out of them, so you might want to let the mini folks know that –- I mean, I've told them they should come out with a setback thermostat, that would be easy for them to do. I would echo the comments from the fireplace insert guy because I have one, they're great. And sort of an observation about zonal, in particular, this I think has great applications for additions, which again are covered by the standards, this is a good way to condition an addition. And I don't know how this is going to impact what happens with additions

because, if someone were to come to me and ask my advice at SMUD how to deal with that, I would go, “Do zonal systems.” No judgment there, but those little Rinnai water heats are great, I think, yeah, absolutely. And I think people use them when they’re needed, I mean, it’s pretty intuitive, you know, you don’t condition your space unless you’re in it. I don’t know if too many people would just go in there and turn it on and walk away, maybe. Maybe that’s why you have the setback thermostat requirement, although we all know how they get used, too. They don’t get used at all. I mean, the little sampling we’ve done at SMUD is people just set them at one temperature and leave it.

MR. WILCOX: Well, I mean, that’s part of the reason that the research that says that if you don’t do setbacks, the zonal system will not save energy. In fact, it might use more energy, and that’s important because I think there’s quite a bit of at least anecdotal evidence that our ubiquitous setback thermostats are really not used the way we think they are in the current standards.

MR. SHIRAKH: Mike, you left before I had a chance. So what you’re saying is, we’re not saying you can’t have zonal, we’re just saying you can’t have credit.

MR. KEESEE: I think people should get a credit if they can.

MR. SHIRAKH: For both heating and cooling? Or just heating?

MR. KEESEE: Both heating and cooling.

MR. SHIRAKH: And if the data suggests that the cooling doesn't save energy --

MR. KEESEE: You're looking at a pretty limited set of data here, I would say. I mean, 2007, things have happened since 2007. I mean, mini splits weren't even in the equation in 2007 whatsoever, and Mike's comments about reducing load, minis might work really well if we reduce load and then the zonal heating, I'll just tell you from experience, yeah, I mean, that's why I did it in my house.

MR. SHIRAKH: I don't think anyone here is disagreeing with the bypass --

MR. KEESEE: You know, that sounds to me like it's a technology fix. I would urge you to talk to some of the manufacturers to see, you know, 2007 is a world away from what it is today, you know, they may have fixed their system since then, you know? That's sort of like Introduction to VAVs in the commercial sector 20 years ago, or whenever it was done, right? They had problems then, too. Maybe this has been taken care of. I'm just

saying, you know, we should encourage people to do zoning. Let's not take away the credit if we can get it right.

MR. SHIRAKH: Thank you, Mike. Jamy.

MR. BACCHUS: Jamy Bacchus, NRDC. I have a question for Bruce or John. In the diagrams and the samples, the houses you looked at, did you find any zone system that actually bad multiple return grills, actually zoned for the return?

MR. SHIRAKH: John is saying no.

MR. PROCTOR: We didn't find any that had zoned returns, we had a few that had multiple returns.

MR. BACCHUS: Is there any reason, in the systems that had zones with them, returns within those, rather space to one common location, was there additional energy saved? Is there a reason we should be looking at that here at the Commission?

MR. WILCOX: Well, we didn't try and measure that. So the question has to do with, is there any reason to believe that having the returned zoned would be a good idea, and I think that obviously there are reasons to think that that might work better, for sure. I mean, if you're proposing to maintain, you know, one zone unconditioned and the other zone conditioned, if you're continuously mixing air between the two zones by pulling

air from one to the other with the return, you know, how well can you actually maintain the temperature difference? But we didn't try to measure that in the field, it just seems obvious. The current zonal rules do not requirement that there be any dampers on the returns, but it does require that you have a return in each zone. So, I don't know, it's sort of half-way between. That's to get the credit. There's no requirement that, if you want to put a zone system in, that says you have to do that.

MR. NESBITT: George Nesbitt. On the field studies, did you break out the data at all between PCS motors and ECMs, or the results? Are they dramatically different or --

MR. WILCOX: Well, in theory, I think they could be, I think these were all PSE motors that we found.

MR. NESBITT: Okay. To answer the one, well, I would say yes, ban the bypass, absolutely, get rid of it. Mike Keesee kind of asked about technology changing and I think a lot of manufacturers, now that we have -– oh, one of the solutions, as you say, we need variable capacity equipment, which I think the field data shows that zonal systems are actually variable capacity, they just come at the price of efficiency. So, with the ECM motors and variable capacity, or two-stage compressors, it seems

that zonal systems are going away from bypass, that would be my impression, because they can reduce the air flow to match statics and whatnot; now, whether or not they're actually performing any better or not, because of issues like not doing load calcs or duct designs, which is a humongous issue, probably the only thing that is violated more than not pulling a building permit is not ever submitting your load calc and showing that you're meeting that standard. But, anyway, so I don't know, John, have you looked at variable capacity of airflow zone systems, any other studies? Are you seeing similar results or better results, but still not good results?

MR. PROCTOR: Yeah, John Proctor. Unless Brushless permanent magnet or ECM motors provide a higher efficiency, generally provide higher efficiencies of the air conditioner, and it is a way of doing multi-zoning that eliminates some of the problems associated with a single speed machine. And we've modeled all that, there isn't a lot of measurement on it. One other thing I like to point out is that the question here is whether or not there is an energy savings, the reason why there's a credit in Title 24 is for energy savings, not for comfort improvement. And zone systems, I don't think anybody is going to argue, a zone system can't provide more comfort. And I think that it should be sold based on that, rather

than a somewhat questionable claim or, in my opinion, totally questionable claim, that on the average you're going to save any energy.

MR. WILCOX: I think the answer is we haven't measured any of them, George.

MR. NESBITT: Okay. Although, of course, with high static pressure, the whole energy efficiency of the air flow is –- but -- so -– do you actually get credit under the zonal credit on space heating currently? So this is not an air conditioning only credit like most of the other credits that have to do with air flows or anything else?

MR. WILCOX: No, it's -– you get a bigger setback and you have to be able to zone on a sleeping vs. living zone basis, and then you're assumed to not condition the living zone at night and not condition the sleeping zone during the day time.

MR. NESBITT: Right, okay.

MR. WILCOX: It's a very optimistic set of assumptions, I would say.

MR. NESBITT: Yeah. Well, and the whole setback, I think there's a misconception that setback thermostats are required for all conditioning systems, it's only really essential systems, so by putting in a wall furnace, I don't need a setback. If I put in a mini-

split, technically I don't need it if I'm reading the Code right. I've had that misconception, too, but perhaps that's something that needs to be made more clear, or we just need to say all heating and air conditioning systems shall have a setback thermostat, even though I think many of us realize they don't always work the way they should. In fact, well, yeah, that's a whole other discussion. On the one hand, yeah, it seems like if you do a zonal system right, you can get energy savings, but that's probably not what happens most of the time. One the one hand, it does seem like it would be nice to leave the credit and it doesn't seem like a credit that's taken often. On the one hand, people are constantly encouraging people to do the zone systems, that's one of the selling points of radiant floors is, you know, throw a zone in every room with an additional 85-watt pump and, well, there goes your savings. So, I have kind of mixed feelings. I tend, when I zone a system, I tend to go to two systems, and I suspect on multi-story houses, especially, it's cheaper to go to two systems than it is to go with all the additional controls and dampers and getting ducts between floors, but it would be interesting to know why the multi-system zoned projects were actually done that way, whether that was a cost issue or what. And then I guess, the clarification,

so, John, your clarification on the ACCA results, as well as your field results, those are measuring things in the same place, but are you saying that the theoretical loss in efficiency taken from the manufacturers' data was then actually taking those as different measurement points, and that's why it's a straight line and they don't match? Is that --

MR. PROCTOR: The original model that is shown in the previous slide is an extension of the manufacturers' data tables, extrapolated. And so, there's good reason to not believe the left-hand side of those lines.

MR. NESBITT: Okay. Right, so we shouldn't make anything, the fact that the field data doesn't match it, but that ACCA and you agree, basically, the field. Okay.

MR. SHIRAKH: Okay, any other comments in the room? The zonal, Pat?

MR. SPLITT: Pat Splitt from App-Tech. First, just a couple of observations. I do mechanical design, mainly radiant out in Santa Cruz because we don't have a lot of air conditioning, and one of the reasons that we get into these systems or multi-zoned systems is that the architect didn't put anyplace to put the ducts anyway, so you can't run one duct system throughout the house. So it has nothing to do with energy efficiency or cost-effectiveness, or anything, it's just they needed to come

up with a feature to cover up their mistake. And I almost never -- I probably never have used the credit for multi-zone, but I know the few systems that do take credit, probably half of them don't actually qualify because they just have a two-zone system and they take the credit and nobody knows that it's not right because very rarely do you have all the bedrooms clumped on one side of the building and the living area in another, there is always the master bedroom is over here, and the kids are over there, and it just doesn't work. So even those few that do take this credit, probably most of them don't qualify. I had a question about some other systems like high velocity duct systems, or fan coil systems where maybe you can't get that 350 CFM a ton, and have you looked at those and seen how those are affected by some of your requirements?

MR. PROCTOR: I think the 350 CFM per ton and the .8 watts per CFM, there are particular things that we need to look at such as the mini-split that we were talking about and the high velocity systems, and we haven't talked about that yet.

MR. SPLITT: Yeah, I ran into situations where I'm putting first company of fan coils because I can't run ducts all over the place, so I may just have – usually you have to find a bathroom or something like

that where you can draw this and put in a system, and then to radiate out to the rooms right around it, so those might be very low loads, and you might need four different systems to meet your load, but they've sort of eliminated all the really small unit. To get a small fan coil, you have to basically go to a European system and they're not really set up with all our controls, and you end up having to put in transformers and fan switches and a lot of stuff, and it gets expensive fast. So, if we're talking cost-effectiveness --

MR. WILCOX: You're talking about a heating system, only if it's a fan coil?

MR. SPLITT: Mine are mostly heating, but they could be heating and cooling.

MR. PROCTOR: Because the CFM per ton is only a cooling requirement, right?

MR. SPLITT: Well, here comes the next question, then, and I think this is the last one. Are you considering eliminating bypass for forced-air systems that are heating only? Because a lot of times what people will do is they'll put in a four-stair system, especially in my area, and prep for air conditioning, so there is no air conditioning there, but they put the boxes in there for the coil.

MR. PROCTOR: And a bypass duct.

MR. SPLITT: No, they didn't actually put the bypass in, but it's set up for it, so it could be put in there, but it's not actually there. Some of them are there, it depends on the manufacturer. So, anyway, if you don't eliminate it for the heating system, then it's going to be there when they put the coil in. So that's it.

MR. SHIRAKH: Thank you, Pat. Any other question? Mike?

MR. HODGSON: Mike Hodgson, Con-Sol. So it looks like we have about 10 percent of the market using bypass ducts and, if we are, that's a significant portion of the market, and I understand the energy implications and we're saying that we're going to fix it by basically prohibiting them from doing that. Why are they doing that? Are they doing it because they're getting a credit in energy efficiency? My guess is the answer is no, they've probably been sold a system by some HVAC or subcontractor, or a manufacturer rep that says this does something, and I presume it's related to comfort. So if that's true, and the market is responding to that, I mean, 10 percent is a significant response, then the homeowner likes this for some reason. I'm not saying it's a good thing or a bad thing, I'm just say why are they doing it, and my guess it's not you're going to save

$45.00 a month on your air conditioning bill, it's a variety of reasons. Now, whether it's health-related, don't know, and so I'm thinking you're solving a problem here with a larger stick than possibly you need. I understand the energy implications and so maybe the credits should become negative rather than positive because I don't know why the market is doing this and this is not –- it's not an energy issue, and so I really think we should dig a little deeper on this issue and say, "Why are you using a bypass?" Is it because you've been sold this as a healthier home, or you have asthma and allergies, and this ventilation system helps filter the air more? I don't know the answer, I'm making that up, but this is not one or two houses, this is 10 percent, right?

MS. BROOK: What you're saying is not make it a proscriptive requirement, but make it that you can't put in a duct because you could be putting it in for a non-energy reason, but instead you treat it –- you just deal with the energy part by making the credit negative or something like that?

MR. HODGSON: My concern, Martha, is I don't know why people are doing this, and the result of the recommendation is bypass ducts should be prohibited.

MS. BROOK: Right.

MR. HODGSON: I understand it from an energy standpoint that you guys have data to say, you know, 30,000 sensible load s going down to five, that's silly. But there may be another motivation for people who want to do this. Obviously, it's not energy. I doubt they're being sold the energy story here, right? If it's not, then there may be a health issue, there may be other issues that people -– I don't know why people buy the system, so I think a little bit of exploration and, then, if it sounds like there is a market segment that is responding, 10 percent is a big market segment, then say, "Okay, this is an energy loser," and the energy user needs to be penalized, and then you penalize them.

MR. WILCOX: Interesting idea.

MR. HODGSON: Yeah, just different options. I don't know the answer to that, but my concern is, any time you start dealing with that big of a market segment, and we don't know what we're doing with it or why it's responding that way, I mean, if we said we had 10 percent cool roofs at .3, I mean, that's a huge number, right? We'd all get excited about that. I'm saying 10 percent would bypass ducts and we don't know why they're there.

MS. BROOK: Well, so you could guess, right? You could guess one of the reasons they're putting in zonal systems is because they're getting advertised as energy

efficient and comfort improvements, right?

MR. PROCTOR: I think I can answer that question, actually. The reason why the bypass is in there is because of the velocity and noise; if you didn't have it and you made no other adjustments --

MR. HODGSON: You mean the ducts are undersized?

MR. PROCTOR: Yeah, meaning you can't put 400 CFM or 350 CMF per ton through half a system, you can't even put it through a whole system in California, but you certainly can't put it through half a system. And there are other options that Bruce mentioned and that is to have some that basically have some spillage into the other zone, and the other zone still has some load, so there are other and better options than the bypass, and I don't think the customer is sold the bypass, the customer is sold the zoning.

MS. BROOK: Right, right.

MR. PROCTOR: I mean, they don't even know there's a bypass, they've never been up to their attic and seen it and wondered what the heck it was.

MS. BROOK: Right.

MR. HODGSON: Okay.

MR. GABLE: Mike Gable. But looking at the data, though, it looked like to give it the proper penalty would be really complicated. I'm concerned that,

actually, if you don't model the way the system is going to function, some reasonable way, you're actually not going to give them enough of a penalty in many cases. So I'm actually concerned that that's actually a real problem to implement Mike's idea. Mike's idea conceptually makes sense, but to actually implement that, to my eye, looked kind of hard. I don't know if you wanted to comment on that, Bruce, or --

MR. WILCOX: Yeah, I've never thought about doing it this way. But it seems inherently more difficult, but maybe it's –- if Mike thinks it's a good idea, then we should look at it.

MR. SHIRAKH: I mean, going by what John said, that it is basically an attempt to get around the problem of having too much air and half the ducts, it seems like there are other solutions to that, rather than having a negative credit. Any other questions or comments? We kind of need to –- we're only about an hour behind schedule.

MR. NESBITT: George Nesbitt, I just quickly wanted to say fan coils are just like any other air handler, there's no issue with air flow other than design, but the high velocity systems are, by design, a lower CFM per ton, and how that works with efficiency in reality. I actually duct tested a system I installed and

it appeared to be horrendously leaky, even though I sealed every single stinking seam, joint, intersection, connection blah, blah, blah, so they kind of pose some interesting questions.

MR. SPLITT: Well, I'm not going to comment, I just commented on my comment, but I just wanted to make one comment that you should look at, is the Green Code now is requiring manual JD&S ACCA calculations and, once it finally gets into the system, that people are actually going to start looking for that stuff, and your systems are actually designed more correctly, some of these problems might not be as big a problem if people really do put in a system that leaks, that they design to.

MR. SHIRAKH: Okay, thank you, Pat. So any questions online?

MR. ROY: This is Aniruddh Roy with the Air Conditioning, Heating and Refrigeration institute. Can everyone hear me?

MR. SHIRAKH: If you speak louder, it would be --

MR. ROY: Okay, this is Aniruddh Roy with the Air Conditioning, Heating and Refrigeration Institute.

MR. SHIRAKH: That's a lot better, thanks.

MR. ROY: Okay, sure. We submitted our comments to both Bruce, as well as CEC with respect to some of our concerns on the way the test set up was conducted, or the

test was set up and that could have also affected the results. And also, you know, we provided some studies which show that there are energy savings associated with zoning, one of them was the NAHB study that was referenced in Bruce's presentation. We do have some concerns with respect to the current presentation, today's presentation, and would like to submit further comments after we get it reviewed by our members. I know the deadline says July 25th, but we would appreciate some more time.

MR. SHIRAKH: Actually, we're allowing people to submit comments by August 5th if that's possible.

MR. ROY: Okay, because, you know, earlier in the call I heard August 12th for some reason –

MR. SHIRAKH: Right, our preference is August 5th, but if you must have until August 12th, by all means.

MR. ROY: Okay, we will try to submit that by the deadline of August 5th, but, if not, definitely by August 12th, you'll hear from us.

MR. SHIRAKH: So you mentioned there might be energy savings associated with zonal controls. Are you specifically talking about the bypass duct system or the other strategies to achieve zonal controls?

MR. ROY: With mainly talking about the fact that, you know, the whole zoning credit that has been

offered, the manufacturers feel that zoning is a way to, you know, get energy savings and that's where we sent in our comments, we sent those two studies, which explain exactly, which have all the details on how the energy savings can take place.

MR. SHIRAKH: Yeah –-

MR. ROY: It's a combination of bypass, as well as the zoning systems.

MR. SHIRAKH: Okay. So we will appreciate your comments, by the way, by those deadlines.

MR. ROY: Sure.

MR. SHIRAKH: Any other comments online?

MR. WARE: A few comments. The question is from Craig Messmer. "What is the proscriptive air flow requirements for SDHV system?"

MR. SHIRAKH: Say that again?

MR. WARE: SDHB System, proscriptive air flow requirements?

MR. SHIRAKH: But we don't understand what SDHB is. If the commenter can clarify that?

MR. WARE: We'll go back to that.

MR. SHIRAKH: HVAC, maybe it was?

MR. WARE: It might have been a typo.

MR. WILCOX: What's the proscriptive requirement? Is that what the question was? The proscriptive

requirement is 350 CFM per nominal ton in cooling mode.

MR. SHIRAKH: Three hundred and fifty, right? Any other questions?

MR. WARE: Another question from Craig Messmer. “In your example for House 41, you mentioned mild and maximum bypass. How would you define mild and maximum?

MR. PROCTOR: This is John Proctor. I have to figure out which one of these is House 41, but it appears to me that roughly at 27 percent bypass was mild and something between 40 and 45 percent was maximum.

MR. WARE: Another comment from Craig Messmer. Zoning for modulating capacity systems should still get credit. Your presentation speaks mostly about single capacity units, multi-capacity equipment will almost always show an increased efficiency. If you have to limit zoning only, do it for single capacity equipment.

MR. SHIRAKH: Well, and that’s the kind of comment we’ve heard from others. Thank you. Any other?

MR. WARE: Gregg Harrod asks, “Would dump zones be prohibited along with bypasses?” Dump zones.

MR. PROCTOR: This is John Proctor. The unfortunate definition of a dump zone is a zone that’s unconditioned and you throw your capacity away by putting it into a dump zone, which seems to me just about as equally stupid as the bypass. There’s no reason that we

shouldn’t put that conditioning into space that’s normally conditioned, so it doesn’t outlaw dump zones, but probably it should.

MR. SHIRAKH: Thank you for bringing that to our attention. Any other questions?

MR. WARE: Thomas Trimberger. “People are using bypass because they have been sold a piece of trash.” [Laughter] As shown, zoning could be used without bypass, it’s been sold for years in commercial and residential and it’s trash, just ban it.

MR. SHIRAKH: Well, thank you, Tom, for sugar coating your comments. I appreciate it.

MR. WARE: That’s it.

MR. SHIRAKH: That’s it.

MS. ADOLPH: Tiger Adolph from Building Performance Institute. I’d like to commend the Commission on taking really what’s the next step in the code. You’ve done all the fruit on the ground, now you’re going up to the fruit that’s off the ground, and it’s going to require a lot of support in the contractor community for actually being able to do some of their own measurements and diagnostics. And fortunately for California, Building Performance Institute actually has professionals out throughout the state now, with over 2,000 BPI certifications that can do everything from the

ACH measurements for the blower door testing, blower door guided air sealing, and even the duct testing, so that's a support mechanism that hasn't been there in the past, that is certainly available to the building contractors all throughout the state now. That's it.

MR. SHIRAKH: Thank you, Tiger. Appreciate it. Jamy, I really want to move on.

MR. BACCHUS: Building on the last comment, not Tiger's, but the previous, perhaps we should look not just at omitting the bypass duct, but the bypass dumper, wherever it's dumping, in case they decide to put the unit in a return air plenum of some kind.

MR. SHIRAKH: Okay. All right, then let's move on to the next –- again, I don't want to discourage people from commenting on this, you just have to do it in writing to us by the deadline.

So the next topic, we're about an hour and 15 minutes behind, it's Advanced Envelope Framing and Abhjeet is going to present that for us. Thank you.

MR. PANDE: Okay, this is Abhijeet Pande with the Heschong Mahone Group and I'm going to just give the introduction and Elizabeth McCollum from HMG is going to do the overall presentation. But just to set the context, what we are going to present here are two related topics, one deals with proscriptive requirements

for wall insulation, and the other one deals with some compliance options. And just as an overall note, the proscriptive options that we are recommending are based on the maximum efficiency measures that you can cost-effectively justify and are feasible, so it's similar in concept to what was presented earlier today as the A1, or the first package of the max potential. So, just keep that in mind while you go through the presentation, and then Elizabeth will talk a little bit more about some of the differences when she talks about the details. So, Elizabeth, if you are on, you can take it from here.

MS. MCCOLLUM: Okay, have I been unmuted?

MR. ABHIJEET: Yes, you are.

MS. MCCOLLUM: Okay, thank you. So, as Abhijeet mentioned, we're presenting two case topics here in one presentation. The first I'll go over is our recommended proscriptive standard for wood framed walls in residential buildings, and the second is a set of compliance options in the form of Lookup Tables in the JA4 Appendices.

So our aim here was to find the lowest U Factor meeting the cost-effectiveness and feasibility requirements by Climate Zone, so we were looking for the highest energy savings with a negative lifecycle cost, and not necessarily the most cost-effective improvement

or highest cost savings. And the variables we looked at in the study were a framing size that's basing cavity insulation type in our value and external insulation type in our value. And in our cost assumptions, and there are different ways to achieve an R Value within the cavity, these are the assumptions that we used in our costing of the measures. So, for cavity insulation of R13, 15 and 19, we're using a standard batt insulation, for R15 and 21, we were looking at high density batt insulation, and in 17 and 29, we were looking at closed cell medium density foam filling the majority of the cavity, and then for R24 and R26, we were looking at a flash and batt scenario where we had two inches of closed cell or medium density foam with a batt in there with that.

So here is one of the cost tables. This cost table looks over the cavity insulation costs, so everything from the interior wall up through the framing and cavity insulation, and I have a note here that the cost that we used per inch for the high density batt insulation was seven cents per square foot wall, the CEC Package A analysis used $.13 per square foot, so that's one of the reasons why our recommendations differ. We averaged across location and similar products to come up with these values. And you'll note here that we have both 16-inch on center and 24-inch on center in the 2' X

6’ framing size, and we have a lower cost for wall framing in 24-inches on center, so, in our analysis we focused on that 24-inches on center because we could get additional energy savings with the lower cost.

These values look at the cost from the outside of the stud to the façade of the home and, well, first off, note that in our zero column, that last digit under three coat cement stucco, and exterior cost should be deleted. But the data that we have from RS means for three coat concrete stucco and synthetic stucco suggests that synthetic stucco, which includes an inch of foam insulation on the outside, is more expensive, however, the feedback we’ve received from the industry is that it’s actually 20-25 percent less expensive to go with the synthetic stucco, which includes that R4 external insulation instead of the three coat concrete stucco, which doesn’t have any exterior insulation included with that. So, that’s another influence that the CEC is aware of, that may have affected their recommendations, and that in any scenario, having R4 on the exterior would be less expensive than going with the same wall assembly with just the three coat concrete stucco on the outside.

MR. SHIRAKH: Elizabeth, there is comment here from Mike Hodgson.

MR. HODGSON: Elizabeth, quick question. Why are

you looking -– at are you looking at EIFS systems for synthetic stucco?

MS. MCCOLLUM: Yes.

MR. HODGSON: Okay, the building industry doesn't use EIFS systems. We use one coat stucco with a drain plane and an EIFS system is a sealed commercial synthetic stucco system, so I'm kind of curious why you would be looking at EIFS in the residential market?

MS. MCCOLLUM: When we started to investigate the different products out, EIFS seemed to be most readily available and well understood, so there are standards written for EIFS insulation and, so, less error for moisture problems and that sort of thing because they've addressed all those issues through the EIFS Association.

MR. HODGSON: Okay, I just give you a heads up, it's not used in new construction on the west coast.

MS. MCCOLLUM: Thank you, and that may explain the reason that we have a different cost estimation than what we're hearing from the construction industry.

So this is the lifecycle cost calculation and I'll talk a little bit more about the variables here in a minute. You'll notice the blue highlighted cells, those are the recommendations that we are making. In many cases, it was cost-effective to go up to an R8 exterior insulation, however, we did not find much precedent for

RA in residential construction and, so, feared that pushing things that far might result in installation errors and other problems in the field, so we capped it off at R4. Additionally, we were trying to make this such that, to achieve the U Factor in any given climate zone, you had alternatives to achieve that, that were not so far off from the current requirement. So, in each climate zone, we found an alternative that only required one variable to change. That may not be the most cost-effective combination of variables. I guess I'll jump into this now, okay, so the variables we looked at were external insulation value, cavity insulation value, stud spacing, and stud size. So, to get the U Factor in Climate Zone, let's see, so Climate Zone 2, R19 cavity insulation with R4 external insulation, we used R19 and R4 in our cost analysis and it came out cost-effective, but an alternative would be to stay within your 2' X 4' framing, 16-inch on center, R13, and add R8 external insulation. So you have alternatives to meeting this requirement. You could go with R19 or R4; we know that that's feasible and that people are doing that out there in the industry. We could push it further and do R8 on an R13 wall, and therefore we are pushing in multiple directions here, we're both encouraging folks to move into 2' X 6' construction with R19 and encouraging folks

to take that internal insulation to a higher value if they choose to go with the 2’ X 4’ wall, so the thought here is that, if we can make our assumption a 2’ X 6’ wall and push the industry that way, there will be more room for improvement in the future. If we just push the external insulation, we’re going to get to a point where you can only add so much external insulation to a 2’ X 4’ wall. I hope that makes sense to everyone. You’ll notice in Climate Zone 7 that it doesn’t appear to be cost-effective here. We wanted to do Climate Zone 7 with 6 and 8 according to our cost analysis, it was not cost-effective to change the insulation at all in that Climate Zone, but if you consider that we’re hearing from the industry that it’s cheaper to do a synthetic stucco, which includes R4 exterior insulation, then that R13 with R4 exterior insulation, which should be cheaper than just R13, would also meet the U Factor requirement for that climate zone. So the R19 cavity insulation with zero exterior insulation is a very similar U Factor to R13 with R4 exterior insulation.

Another difference that we have from the CEC recommendations is that we pushed Climate Zones 13 and 15 a bit farther and recommend R26 cavity insulation, which requires flash and batt insulation, or some use of medium density insulation. The CEC recommendations stuck to a

cavity insulation value that could be met with batt insulation alone, and maybe that's the reason that they kept it at R21, and the other reason would be, you know, with the insulation values that are currently used in the 2008 Proscriptive Standards, the highest is R21, so that may be among the reasoning, I'll let them comment on why they choose not to take it further, even though we have found it to be cost-effective.

So in our energy analysis we looked at cavity insulation for both 2' X 4' and 2' X 6' assemblies from R13 up to R29, continuous insulation values from R0 to R10, and we didn't have cost information on all of these, we simplified our lifecycle cost analysis to include only R0, R4, and R8.

And we looked at different framing factors for 16-inch on center, we're using the standard 25 percent framing factor, and then for 24-inch on center, 22 percent framing factor. This is just the studs facing, this does not include any other advanced wall framing techniques. And these are the standard framing factors that have been used in the Code in previous cycles.

Here, I'm showing the current standard compared to the proposed standard and you'll notice in every case we're switching to 24-inch on center framing with 2' X 6'. Again, in Climate Zones 2 through 10, the current

requirement is only R13, which can be achieved in a 2’ X 4’ wall, so we capped those climate zones off at R19, R4, so that there is still an option to achieve compliance within a 2’ X 4’ wall, using R13 cavity insulation and R8 external insulation. That said, it was cost-effective to go further in most of those climate zones.

MR. SHIRAKH: Comment?

MR. SPLITT: Pat Splitt, I can’t follow this at all. Didn’t we just decide that we were going to have R4 insulation for our packaging on everything? So what is this – what are we talking about?

MR. PANDE: This is Abhjeet. I’ll answer that. So this analysis was done prior to the CEC putting together the packages, this is the case recommendation for what we attained as the most efficient you can get in terms of still being cost-effective and feasible. These may not necessarily line up with the CEC Packages that were presented this morning.

MR. SHIRAKH: We used elements of this to come up with a package that Bruce presented this morning and they don’t always line up because we had different assumptions for the cost and the different interactions with others.

MR. SPLITT: So we should have done this first and then said, well, now that we have this, we’re going to do that because we changed Package A, right? It’s now

-- isn't that the proposal, exterior for everything?

MR. SHIRAKH: The packages that you saw this morning, Package 3 and 3B, is what staff is recommending. We drew upon this analysis, that's why we're presenting it.

MR. SPLITT: And we're saying here -- we're doing an analysis --

MR. SHIRAKH: It doesn't line up, we understand that.

MR. PANDE: And just to reiterate my earlier point, this is probably closer to the first Package, the A1, or whatever the 1A Package.

MR. SPLITT: Right.

MR. SHIRAKH: So this just established the basis for a lot of the things we did, but we changed it somewhat to come up with Package 3A that you saw this morning. Go ahead, Elizabeth.

MS. MCCOLLUM: Okay, we can move on to the next slide. And this just shows graphically the proposed change, so the light blue being what the U Factor requirement was in 2008, and the dark blue being our proposed 2013 U Factor. So for the compliance options, we, well, in addition to proposing these new proscriptive standards for wood framed walls, we also revised the JA4 Table for Wood Framed Walls to exclude bias towards

certain insulation types and add additional cavity insulation options, so you can achieve a higher R Value per inch. We added new lookup tables for advanced wall framing and insulating concrete forms, and we revised the fifth table to include tables, there were three of them, to include additional products.

So this is what the JA4 table looks like for 2008, and you'll notice that it calls out batt insulation, and that's to assume that is going to be the primary insulation used in the field and I'm sure that that's the case. This table separates out foam plastic or cellulose insulation to one category and it doesn't very well accommodate medium density foam insulation. And so, in the 2013 proposed table -- go to the next slide -– we excluded all mention of insulation types in the table itself, and this is the first half of the table, so this is just the 16-inch on center half. And you'll notice we go all the way up to R17 in the 2' X 4' up to 29 and a 2' X 6', and if you want more information about special requirements under these R Values or what it takes to achieve these R Values in a cavity, those are in the notes in the bottom of the table. So here is the 16-inch on center, the next slide will show the 24-inch on center values.

MR. SHIRAKH: So this is Mazi, and this is

another reason why we're showing this, because JA4 is going to look different because of this proposal.

MS. MCCOLLUM: And we used easy framed to do these calculations consistent with previous versions of the table. And so the next slide we have the notes for these tables. Continuous insulation may be installed on either side of the wall. For some of these, certain R Values can only be met with certain insulation types currently, so we mention when medium density insulation is needed, when high density batts are needed, and we also call out that the R Value for low density installation shall be 3.6 per inch thickness, and the R Value for medium density insulation shall be 5.8 inch per thickness. Next slide, please.

And just continuing on, these notes are – there are notes in there for when certain types of insulation are required to meet those values, so that people don't just go pick any value and assume you get there with the batt.

So, for advanced wood framing, we came up with a set of techniques and practices with our Project Advisor Committee and agreed on a definition for advanced wood framing and that includes 2' X 6' at 24-inch on center wall framing, precise engineering of headers on load bearing walls, 2' X 4' headers on non-load bearing walls,

eliminating triple studs at windows and door openings less than four feet in width, aligning door and window openings with standard stud spacing, two stud corners instead of three stud corners, ladder blockware interior partitions intersect exterior walls instead of three stud channels, eliminating unnecessary double floor joints underneath non-bearing walls, using metal lead and T-Bracing on non-shear walls and including detailed framing plans and elevations on permit sets. And we use the tables developed by Jon Leber to calculate framing factor and altered them to include these practices and came up with 17 percent framing factor in a 24-inch on center framing assembly, as opposed to the 22-inch that is current assumed in Title 24.

We plugged these into each frame, again, and our typical advanced wall framing U Values range from .021 to .065, the average cost savings was up to $1,441 per prototype D home. So, obviously, it is cost-effective if we're paying less and savings more energy.

So our proposed Code changes just include adding a lookup table to JA4. The credit for this compliance option would include quality insulation installation, inspection, and on top of that QII, they would an inspection of the framing to make sure it met the requirements I listed earlier.

So the next table, we can see what this looks like. We took the same format that we used in the standard wood frame wall assemblies table and repeated it for advanced wall framing. So this is just the top portion and it continues on through 2’ X 12’ assemblies.

For insulating concrete forms, we’re talking about stay in place panels of insulating material for constructing cast in place solid concrete walls, for this study we used a one-dimensional – let me get the right terminology here –- we used a one-dimensional calculation as documented in the 2007 ASHRAE Handbook of HVAC applications to construct the lookup tables. Our values do range from .022 to .058. The increased construction cost we found was $6,036.00 per home, and all we’re doing here is adding a lookup table for a compliance option, no inspection required.

So this table is on three slides, so you can see here, it’s broken down by insulation type and we have the U Factor and heat capacity listed here. So here you see we also have XPS and polyurethane insulation types. And then finally, cement EPS compound which is used in waffle screen-type ICF, so the notes here, we have flat insulated concrete forms, the waffle and screen type inflated concrete forms use a cement EPS compound rather than a rigid insulation, and then just our value

assumptions given the density of the EPS insulation.

And finally, we altered the SIP Assembly options to include the blind types and additional core insulation values, so for anyone that is not aware, SIPs have a foam plastic insulation core bonded between two structural facings, and we looked at walls, floors and ceilings, for SIPs. So next slide, please.

So here you can see that we've added the spline type and that's the main change, we've also added additional panel thicknesses, and we have similar tables for roofs and floors, this is just the wall table. And the notes for the SIPs table: inflation value must be at least R14 in order to use the table, you know, just some different assumptions and values assumed in this table.

MR. SHIRAKH: Okay, thank you, Elizabeth. Any questions for her in the audience? Pat.

MR. SPLITT: Pat Splitt, App-Tech. I had a question about the section on ICFs, there are wall assemblies that basically are either inverse of an insulated concrete form where the insulation is in the center of the concrete wall, and I didn't see anything there about that, that there are several different types of systems, Shotcrete and others, it's formed in place and are there tables for those?

MS. MCCOLLUM: No, we only looked at those

systems that have foam on the outside, so we're insulating the concrete. We didn't look at those other system types.

MR. SPLITT: Will there be tables?

MR. SHIRAKH: Are there – in J4 we have them.

MR. SPLITT: But I think they should be expanded.

MR. PANDE: Just to understand, you are talking about a system where the insulation is in the middle and you have structure –

MR. SPLITT: Concrete on the other side.

MR. PANDE: So that is addressed in the SIPs tables because that is essentially what it is.

MR. SPLITT: But there's no mass taking credit for it.

MR. PANDE: The mass -– that's right.

MR. SPLITT: But there is something now.

MR. SHIRAKH: We can always add 2J4 because that's kind of like, you know, we can do it in between cycles, too. So even if there is -– okay, there's our expert.

MR. WARE: Dave Ware, Commission staff. The objective is to update the thermal mass portions of the JA4 table so that they're a little easier to use, and I think that would accommodate your question, Pat, related to thermal mass wall techniques where there is insulation

placed on the outside or on the inside.

MR. SHIRAKH: Thank you, Dave. George.

MR. NESBITT: George Nesbitt. A couple things with the lookup tables. On the walls, there's a couple of assemblies that I believe show either a 2' X 4' wall insulation and a 2' X 6' wall, or a 2' X 6' wall insulation and a 2' X 8', which we know creates large convection currents and doesn't work, yet I believe the values in those tables really don't reflect a reduction in the performance. And it's not a practice we want to encourage, especially with QII.

MS. MCCOLLUM: Right, all of the values here are -- well, with the exception of medium density foam, which also creates an air barrier, all of these assumed values fill a cavity.

MR. NESBITT: Right, right. I see that. I see a 2' X 8' with an R19, and if that's a batt, that a) does not meet QII, and we know that doesn't work in the real world, which I would say, having lots of notes on tables is a bad idea – who reads notes? It's like asking for directions. I would say maybe we should make more tables, but split it between product types, so have one table for batts, and so you would never show an R19 batt and a 2' X 8' wall for a wall, and even though it means more tables, it would probably provide greater clarity

than trying to make one table fit multiple materials with totally different R Values per inches and having to read every little note that -- so that would be one thing. And the other comment is --

MS. MCCOLLUM: Wait, can I respond to that before you move on?

MR. NESBITT: Yeah, go ahead.

MS. MCCOLLUM: So we considered that option and one of our goals here was to encourage development of new insulation products, and I guess evolution of existing products. So if we had a table for each product within limiting the options to that list of products, and so the reasoning behind making this one table that is complete generic was not to deter people from finding new insulation products and being innovative.

MR. NESBITT: Right, yeah, it just may complicate it. And another point is an R19 batt and a 2' X 6' wall is an R17, we may want to make that more clear to people, that using an R18 and a 2' X 6' is actually a penalty because you're only getting R17 on the cavity, so you're not getting what you're paying for. And then the other thing is the cellulose note always says you have to have a binder, yet it is -- and I'll bring this up at the QII thing on the 25th, again, is we as HERS Raters are -- we are verifying jobs with wall insulation, with spray-in

cellulose and fiberglass behind netting, under QII, as well as we have been passing spray foam before 2008 Code and have and will do high density foam which is -– sorry, low density foam, which is currently not in QII, so we are not recognizing several insulation systems as it is because you do not put in a binder with a dry pack cellulose or fiberglass in a wall behind a net, you only do that when you wet spray it, and we can do fiberglass in a wet spray, as well as cellulose.

MS. MCCOLLUM: Thank you.

MR. VARVAIS: Dan Varvais with the Spray Foam Alliance. First, we really appreciate all the work you did to go through and to address the tables. One of the things that we're on record with right now by letter, and we can continue, we want to push especially for this Code revision, we think it's important that our manufacturers get credit for the R Value of the product that they manufacture, not the lowest denominator that's based on less than five percent of our marketplace.

MR. SHIRAKH: Actually, I was in discussion with your industry last year, our problem is we can't do field verification. We asked the industry to come up with some process that, you know, would enable building officials or the HERS Raters to act, verify what product that goes in there and we haven't really had a response directly,

you know, we made some suggestions, maybe you should use a different pigment for different R Values, but the industry didn't like it because I guess different manufacturers have a preference for different pigmentation, and we didn't hear any other alternatives. But, you know, we're not opposed to that idea, it's just you need to tell us, help us, work with us to do the field verification part of it.

MR. VARVAIS: We'll be glad to do that, we're trying to do that, and I think that the hearings on the 25th will help cover all that. That's a big one as far as efficiency and the wall cavity, and then the rest of our comments we'll provide in writing by the 12th.

MR. SHIRAKH: We appreciate that.

MR. VARVAIS: Thank you very much.

MR. KEESEE: Mike Keesee, SMUD. Just a question. How would you handle more advanced insulation types like, I'm thinking Aerogel? Is that the name of the company? Right, or the one I just read here, or, jeez, face change materials. I didn't realize there's a commercialized product, but how would that be handled in this?

MR. SHIRAKH: You know, again, the way that JA4 works, it's actually a living document and we created it like that for that reason, so we don't want to be a static thing between Code changes. If somebody comes up

with a dandy product like that, you can actually get it into JA4 through an approval by the Executive Director.

MR. PANDE: And just further on that, that's also one of the reasons why this table is structured the way it is and not different tables for different insulation or types, so leaving it open actually makes it easier to add more products in there.

MR. SHIRAKH: Any other comments from inside the room? Anybody on line?

MR. WARE: A few comments online. First question, Chris Decareau: "Advanced walls, two types, the EIFs, traditional barrier sealed, the EIFs are no longer used in residential, too high a liability, leaks and wood decay. Drainage or one-coat, two-coat used, still a liability from water leaks, though. Don't base estimates on RS means EIFs?"

MR. SHIRAKH: Okay, any other comments?

MR. WARE: Question from Bruce: How will the new Code allow thermal mass contributions towards positive energy efficiency results? These materials have relatively low R Factors that modulate heat transfer using mass."

MS. MCCOLLUM: You said that question was *for* Bruce, not *from* Bruce, right?

MR. WILCOX: Well, it depends. The models can

handle all kinds of things; there are restrictions on inputs that probably need to be revised, but currently, you know, the inputs are specified mostly in JA4, unless you have a compliance option. So, I'm not exactly sure what kind of materials you're talking about, but the model can handle basically anything, I think, that you'd like to have it do.

MR. WARE: One more comment from Bruce regarding thermal mass, earth is assigned 2.5 R Value in the table for 12-inches and, in a rammed earth wall, it is counterproductive to place continuous insulation anywhere on such a wall."

MR. WILCOX: So the question had to do with the conductivity of earth in ground?

MR. PANDE: Rammed earth walls.

MR. WILCOX: Well, rammed earth was the second part. Was the first part also about rammed earth?

MR. NESBITT: The first one, I think, was a 12-inch – an R Value of 2.5 for a 12-inch earth wall is what it sounded like.

MR. WILCOX: I'm not familiar with the specs for rammed earth walls. And I'm not -– we haven't tried to work on that or look at it, so I'm not up to speed on it.

MR. NESBITT: Actually, since someone raised – or, since the thermal mass issue got raised, if we have

minimum U Values of currently R13 for a wall, two mass walls, to get an exemption in the performance --

MR. WILCOX: No, I believe the statement is that those are minimums for framed walls.

MR. NESBITT: For framed walls, okay.

MR. WILCOX: Yeah, it's not the same requirements for other than wood frame.

MR. NESBITT: And speaking of the minimum requirements for insulation, I believe the software does not disallow you, as a new run, or as an altered assembly, or it does not always tell you, or does not allow you to not put in a value below the mandatory minimum.

MR. WILCOX: Yeah, I believe -– my understanding is that mandatory minimums are not enforced by the software -- in some cases, anyway.

MR. NESBITT: Yeah, I have a colleague who just had with Energy Pro modeled thermal mass properly and she went from like a 50 percent compliance margin to less than 15, so there's like some serious thermal mass modeling issue in Energy Pro at the moment.

MR. WILCOX: And I don't take ownership of that issue, at least until I'm told something different than I currently am.

MR. NESBITT: None was assigned.

MR. SHIRAKH: Any other comments? Okay, if there are no more comments, we're going to move to the last topic of the day, which is a non-residential topic, that's the hotel guestroom occupancy controls. Cathy Chappell will be presenting this.

MS. CHAPPELL: Cathy Chappell, Heschong Mahone Group, and we're obviously switching gears here, looking at guestroom controls, occupancy controls, and hotel/motels. And I think there have been maybe some confusion and different starts on this measure in the past that we have looked both at HVAC savings, and there's been some investigation in the lighting savings, and what we've done now is combine those, as well as other plug-load controls. And this work is done by Elizabeth McCollum on the HVAC side and Owen Howlett from HMG on the lighting side, and both of them should be unmuted at this time and can address any questions or jump in.

MR. HOWLETT: I believe I'm unmuted. Can you hear me?

MS. CHAPPELL: Yes. Thanks, Owen.

MR. HOWLETT: Thanks.

MS. CHAPPELL: So as a summary, what this measure is looking at is the installation of occupancy controls for HVAC equipment, lighting fixtures, and including

plug-in lighting or receptacles. And when we're talking about occupancy controls, we're looking at both car key controls, as well as occupancy sensor-based controls, and not limiting it, but looking at all the options. And as we'll see in the language, what we are proposing now is a mandatory requirement for automatic controls for HVAC lighting and approximately half of the receptacles and, again, in the specific Code language I can show what that means, exactly. And what we're requiring is that the HVAC equipment is set back and the lighting is turned off and the receptacles are shut off, half of the receptacles, when the room is vacated.

And again, what we're looking at is a mandatory change to Section 150 with some references to Section 150 in the HVAC and the lighting pieces, then we're also looking at updates to the ACM Manual and changes in the occupancy usage patterns, and including specific occupancy patterns for the lighting and the HVAC in hotel/motel rooms, and then temperature setbacks at different set points for unoccupied period of the room, and then also looking at changing the lighting schedule. So, what we've done so far, we're in the process of finalizing the analysis, the energy analysis, and we've got some data on some field studies and some other analysis and what the site energy savings is. Most of

these have been done for existing hotels and obviously we're applying this to new construction, but we see that the range that's found, there was a CLTC field study that was done, that was looking at a large range of 70-73 percent of heating and cooling savings, an Edison study done in Palm Springs that had an average of about 43 percent savings, and these are for the heating and cooling savings only. There was a study done by Architectural Energy Corporation, AEC, that we're also looking at that has 28 percent average savings, and then they also had some lighting savings. So we're looking at those and looking at the models that we've done that have shown that it's cost-effective actually at a lower level, we're revisiting those and we'll have some additional final results.

So going back one, basically the takeaway here is that the energy savings here for the heating and the cooling are the values that we're looking at for HVAC, only. And then what we're looking at for the lighting energy savings is we're considering the energy that saved when the guest room is rented out, but that the guest leaves the room without turning off the lights. So this is a fairly conservative estimate that we need to look at, that we have to assume that some of the guest rooms are unoccupied, you know, unrented, and so the lights

will already be off; there are other instances where the guests will leave the room and turn off the lights, and there's not really any explicit data that describes that. And the closest that we have is a PIER study that was looking at hotel bathroom lighting and lighting controls in the bathrooms, and so, after an extensive search, we determined that that was the best available data that was there for occupancy-based savings, so we used that and applied it to other areas.

MR. SHIRAKH: But you're trying to be very conservative because you could also argue that, in the absence of any controls, the light would be on the in room even if there is no guests there, or the air conditioning might be working.

MS. CHAPPELL: Yeah.

MR. SHIRAKH: So you're not assuming that, you're just --

MS. CHAPPELL: Yeah, so we are making some conservative assumptions, you know, to come up with kind of minimum levels, prove to ourselves that it's still cost-effective, and therefore still makes sense.

So this table here is basically just a summary of some hourly data that we'd gotten from the PIER study that had the on/off assumptions for, again, just for bathrooms, by hour. We looked at the energy savings

between 11:00 and 5:00 and basically what that is, again, is a conservative estimate of when people would leave the room and when they would come back, that if the lights are on that, you know, they could be turned off, nobody is in the room. And so, the information that we'll have in our case report, obviously, will have more details on those assumptions and explain that.

And then we took that information and applied it to bedside and desk lighting, which is basically the plug loads, as well as the general overhead lighting. The other thing that we didn't include in our saving estimates was any additional savings from the plug loads that would come from coffee pots or TVs. Then we also looked at some system costs and we actually did this data collection over a year ago, and maybe close to two years ago now, and we're also in the process of getting additional data, some more information on the card key, or key card controls, and there's more information that we've identified recently that we'll be using. But we looked at both the key card product and other occupancy sensor-based, and looked at stand alone systems as opposed to a central system, the central systems are a bit more expensive. And then we took an average of those costs to look at the total system costs.

And then we also added in additional lighting

control costs, $30.00 for wired systems to the lighting, an additional $45.00 for the receptacle controls, and we didn't look at wireless systems, they may have some additional higher component costs, especially for new construction, the wireless systems for the retrofits are actually much more – well, I don't know if they're much more cost-effective, but they're much more doable for retrofits using the wireless. Again, we looked at the wired cost.

So what we have assumed here are the total installed costs, one with the card key with the cost of the lighting and the plug load relays at $175.00 per room, I believe -- is that value correct, Owen? Right, at the top of the page.

MR. HOWLETT: Yes –

MS. CHAPPELL: And then occupancy sensing devices using the average from the previous table, we came up with a total cost of $350.00. And so, again, when we did – we don't have our cost-effectiveness, the final lifecycle cost numbers, we're revisiting those, but these are the assumptions that they're going into and we should have those numbers shortly, we'll have something available and that we'll be posting sometime in August, prior to the September meetings.

So basically what we're proposing here is in

Section 122, where there is space conditioning system requirements, and 122C, making the note that the hotel guest thermostats must meet Section 150Q for the lighting requirements, 130B for hotel guestrooms, adding that the lighting controls in hotel guestrooms need to meet 150Q; and then 150Q, we've added that these I, K and Q must apply, that's what is in 150, and specifically what Q is, it says that all hardwired lighting, HVAC equipment, and half of the receptacles, serving at each guest room, shall be controlled so that no more than 30 minutes after the room is vacated, the lighting and the control receptacles are turned off, and the HVAC system set points are raised by at least five degrees, raised and lowered accordingly. And we make the note that the captive card key system is considered an automatic control. And for the control receptacles, we've added the specific language, which more clearly defines the half of the receptacles, that what we're looking at is that there will be like in a duplex receptacle, there will be one controlled and one uncontrolled receptacle, and that they will be identified as such. And this is consistent with another case proposal that we've submitted and presented previously on office plug load controls, that it's the same Code language.

And the other thing real quickly is just the

additions to the tables, that they'll be the hotel in Table N27, the schedule for guestrooms with occupancy controlled setback thermostats, so there will be the temperatures and also the lighting on/off, and then adding the residential occupancy sensor, adding an additional table to include the hotel/motel guestrooms, with the setbacks for the thermostats and lightings.

MS. BROOK: Just one question there. Why are we -- if we are making it a mandatory requirement, why are we adding instead of just replacing these schedules?

MS. CHAPPELL: I think, Owen, I don't know if Elizabeth is still on the line, or Owen?

MR. HOWLETT: Yeah, I'm here.

MS. MCCOLLUM: Yeah.

MS. CHAPPELL: I think that's a good question.

MR. HOWLETT: It is a good question, I was thinking the same thing when I was looking at the slides. I think the answer is that we developed these schedules initially because we were picking this as a performance option.

MS. CHAPPELL: I think you're right, I think this would be replacing that.

MS. BROOK: Okay.

MR. HOWLETT: It would be replacing it. There may be something that is worth keeping in there to give

people more of an understanding, more of a breakdown of where the savings come from in rooms, but, yeah, I think strictly it wouldn't be needed anymore.

MS. BROOK: Okay, thank you.

MR. HOWLETT: And, Cathy, if we are –- do you want to mention briefly this slight issue over the split between HVAC and hotel rooms being a non-res issue, whereas lighting in hotel rooms is a res issue? And we've tried to develop with the language and mention in the non-res section that there are requirements in the res section, and then vice versa in the res section and say there are requirements in the non-res section to make sure that people can find the requirements from either end, but it is a little bit of a strange split.

MS. CHAPPELL: Split, yeah.

MR. HOWLETT: So we'll have to pay attention to that in terms of -– or perhaps somebody at the Commission will have to pay close attention to that to make sure that it actually meets your needs for Code writing.

MS. BROOK: Okay, can you just reiterate that just briefly, the requirements for high-rise residential? Or lighting only?

MS. CHAPPELL: The res --

MR. HOWLETT: From –- in hotel rooms, the HVAC in hotel rooms is covered under the non-residential section,

Section 130, whereas the lighting in hotel rooms is covered under 150K.

MS. BROOK: I see.

MR. HOWLETT: Lighting point of view hotel rooms are classified as being residential.

MS. BROOK: I see. Thank you.

MS. CHAPPELL: And this requirement applies to both.

MS. BROOK: Okay, thank you.

MS. CHAPPELL: And we tried to do it such that it's just in one place and referenced.

MS. BROOK: Okay, I see, thank you.

MR. SPLITT: I'm still not clear. This is Pat Splitt. Are we just talking about hotel/motel? You flipped through some slides that referenced also high-rise residential. And I couldn't read through to see where you made the distinction, so are these controls for high-rise residential also? Or are you now going to split up your –- before, high-rise and motel lighting was the same, so now are you going to split it up and have a different set of requirements for motel/hotel lighting, then for high-rise?

MS. CHAPPELL: What we're saying, yes, so this does not apply to high-rise residential, but what we have in Section 150Q is specifically – so this is in the

residential portion since it's lighting, and we're having this specific requirement added to hotel guestrooms. So every –- well, our thinking, and I guess this is up to the Commission, as well --

MR. MCHUGH: Could you go back to that slide for a second where it talks about –- I -- thank you.

MS. CHAPPELL: Yeah.

MR. MCHUGH: So I and K are things that in the past have already applied to dwelling units in not just hotel/motel, but also the dwelling units in high-rise multi-family, and so the I and K part is clarifying that and I has to do with the residential thermostat, that also applies to multi-family dwelling units, and K is the lighting requirements, the residential lighting requirements, which applies to the high efficacy-type requirements that are in dwelling units in those occupancies. So it's actually just a clarification of the preexisting standard. So if you go back to Section 130, and I forget the other place, you'll see that they already refer to that, so it's just a clarification.

MS. BROOK: Okay.

MS. CHAPPELL: Correct. If you follow, as John was saying, if you follow this, that when your dwelling units in high-rise res or in hotel/motel, shall meet the applicable requirements in I, K, and Q. And then, so I

and Q are clarifying what is required for both of those, which is not changing, and then Q specifically is saying it's for hotel/motel guestrooms.

MR. HOWLETT: I just want to throw it out that it seems to me that hotel guestrooms are sufficiently different from residential, that it may no longer make sense for the two to be covered by the same section of the Code --

MR. SHIRAKH: They're not the same thing --

MR. HOWLETT: And it may be more logical to treat hotel guestrooms as a commercial space and give them a lighting power density requirement like other commercial spaces. That's a little beyond what we're talking about today, but for working through, it seems like it would reduce the complexity if that change were made.

MR. SHIRAKH: Now, Pat, you're not arguing that we should cover high-rise residential under this?

MR. SPLITT: No, it's just a clarification and there are some occupancies like –- well, right now I'm working on a Zen Center, you know, they're taking a big existing -- actually, they're taking an Alzheimer's Center out in the country and changing it to a Zen Center, so instead of putting a lot of little rooms in. And to model it, I'm sort of modeling it as a hotel/motel, but it's not really a hotel/motel. So I'm

saying, well, I think maybe there needs to be a little bit better definition of just exactly --

MR. SHIRAKH: I think we're specifically, I mean, there's a definition of a hotel/motel in Section 101. Where I'm a little bit fuzzy, what about like dormitories and things like that?

MR. WILCOX: Or Zen Centers.

MR. SPLITT: Or group housing of some sort.

MR. SHIRAKH: Maybe we should think a little bit about how this --

MS. CHAPPELL: How else this applies, yeah. And, I mean, our analysis was looking specifically at hotel/motel data, and applying that further to dormitories and so forth, where Zen Centers would be a different set of assumptions.

MS. MCCOLLUM: This is Elizabeth. I've got to jump off now. Thank you, Cathy and I guess any other questions that Cathy can't answer, I'll have to answer at a later date. Thank you.

MS. CHAPPELL: Thanks, Elizabeth.

MR. SHIRAKH: I was -- just one thing that I was thinking for the lighting, we may want to consider exempt one high efficacy source at the entrance of the room. I only say that because I was sitting in a hotel in Vienna and they had a key card and it worked really good, but

when you walked in the room, it was very dark, so what happens is people are going to probably leave a floor lamp or something on all the time. But if you provide a switch at the door with just one high efficacy source, that may be enough, so they can turn that on, see where the key card thing is, and they can do their business. I had a really hard time with that at night.

MR. NESBITT: Or make the key card have a little LED so you can – so I guess Motel Six is going to have to change its marketing motto, "We'll turn the light off for you, at least in California."

MR. HOWLETT: Mazi, that's a great point. Sometimes they don't put the light switch near the door, but maybe this will give them incentive to make sure that they do put it near the door which is where it should be.

MR. NESBITT: They'll have to pay me a lot for that marketing campaign. But I won't quit my day job. So, I think there's really two levels of control we need with this kind of occupancy, that's a control whether the room is rented or not. And then, even when it is rented, not having lights on when whoever has rented it is not in it, so pretty common these days are the little refrigerators, they're in the vast majority of hotel/motel rooms these days, and they're on even when the room is not rented. So that's kind of like a big use

that should be controlled when the room is not rented. So, I mean, when the room is not rented, there isn't much reason for anything to be on.

MS. CHAPPELL: Yeah, that could -- let me just interrupt real quickly – but that can be addressed with these receptacle controls. I don't know how the Code could directly regulate that, but this is a step in the right direction.

MR. SHIRAKH: Whichever receptacle they want, we have no control over that.

MR. NESBITT: Yeah. Well, there is that, I mean, I have rented plenty of rooms where the air conditioning has been left off and, you know, the second floor, really insulated, dark roof, you know, Roseville, and it's pretty hot when you get in there. So in that sense, I guess the non-occupancy setback gives at least a five degree setback, so at least you're not saying you let it go up to 100 degrees and you walk in, but that's kind of where I say there's a little bit of difference between whether the room is rented vs. not, and if it's not rented, there's really no need for a minimum of a five degree set point; but, then, if it's rented you'd want it to be in a more comfort range, and same thing with the fridge. I mean, I see a lot of fridges in my multi-family projects, they put the fridge in and it may be

nine months before the unit is occupied, and the fridges are plugged in and churning away.

MR. SHIRAKH: I don't think we're done with the presentation yet.

MS. CHAPPELL: Yeah.

MR. NESBITT: She got to the question mark.

MS. CHAPPELL: I got to the question mark.

MR. NESBITT: But generally, this is a good idea and I guess in the bathroom, because it falls under residential, the occupancy sensor will be required at this point in the bathroom, which is probably one of the highest uses, or often a light that is likely to get left on the most.

MR. SHIRAKH: Thank you. Any other comments? Okay, so with that, this is the public comment period. Seeing none, I'm going to close this, just to let you know that there will be one last staff workshop, it's going to be in mid-August, and Martha is going to decide that and send the notice when I'm gone in the next couple weeks, and so this would be basically our last staff workshop. After that, we're going to get into drafting up our final language and go to the rulemaking. So thank you for attending and we'll see you later.

(Adjourned at 3:35 p.m.)