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Introduction: Hello and welcome to our Building Energy Code Seminar Series. The series is based on our National Energy Codes conference, which is hosted annually by the US Department of Energy. We're here to present you with the latest in building energy codes from developments in the model's codes to updates on what's happening across states and local governments to highlighting tools and resources that you can take advantage of in your day to day practice.

We'll be hearing from a number of leading experts about the challenges they're facing, the ways they're working to solve them, and how their efforts are building the energy efficiency, comfort, quality, and affordability of America's homes and businesses. Joins us virtually every week for important topics and interactive discussions and help us continue the conversation. To learn more visit energycodes.gov.

[0:01:00]

Ian Blanding: Welcome everyone. I am Ian Blanding with the Pacific Northwest National Laboratory and I'd like to welcome you to today's webinar based on the National Energy Code Conference Seminar Series. Today's seminar will cover what's new in the residential provisions of the 2021 IECC.

Looking ahead for the seminar series we actually have a special edition seminar that is coming up next Tuesday, November 24. This will cover energy codes around the world and it's actually an NECC and International Energy Agencies energy in building and communities EBS joint webinar. They're going to take tour of energy codes around the world and hear from some of the 15 countries participating in the International Building Energy Codes working group.

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So just to note and we've noted here on the screen this session starts at 10:00 AM Eastern. So in order to accommodate all the different time zones we're starting a little earlier in the US. So 10:00 AM Eastern time not 1:00 PM Eastern as we've typically done for these series.

And then outside of that, after the holiday then we'll get back to kind of our regular scheduled programming staring on December 3

looking at advanced technologies and codes, policy for energy efficiency and resilience and then field studies in the northwest region. And so, to learn more and to register go to energycodes.gov the link is down here below.

Before I kind of introduce our panelists, I wanted to do a quick couple polls just to get a sense of kind of who's in the audience. So if you'll bear with me, if you can fill out this first poll kind of in which region are you located? Would love to get some feedback on that.

[0:03:00]

Okay, we'll close the poll and then share the results. So it looks like kind of a mix but a good representation from the northeast and then kind of equal representation Midwest, southeast, southwest, and west. So thanks for that.

We'll move to our next poll asking about which profession most closely aligns. So if you can fil that out. All right, we'll close, and we'll share. So good representation of architects and engineers, nonprofits, consulting groups, code officials, plan reviewers, third party verifiers, that's all great.

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And then some kind of public organizations, universities, federal, state, and local governments. So thanks for that.

So now we will introduce our panelists. So first up we have Rob Salcido, he's a senior building energy research engineer for PNNL. He joined PNNL in March of 2020. He leads the residential energy codes program at PNNL and is responsible for the advancement and development or residential energy codes. In addition to residential energy code work Rob is a member of the REScheck COMcheck software team.

And then prior to joining PNNL he was a principle with Salcido Solutions a consulting firm specializing in software design, building science, energy modeling, and building energy analysis.

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He has a bachelor's degree in environment resources engineering from Humboldt State University in California as well as a masters in civil engineering from the University of Colorado at Boulder. He's also a registered professional engineer in Colorado.

We also have Todd Taylor who recently retired from PNNL and is now a consultant so he's kind of representing PNNL and has agreed to share his vast experience and kind of historical knowledge of the program and of residential energy codes.

Todd has 35 years analyze and developed residential building energy codes including the IECC, ASHRAE 90.2, federal standards for manufactured housing, and various regional codes and beyond code programs. He specializes in large scale building simulation, economic analysis, utility grids, and analysis of large energy data sets. So thanks to both of you for being on today.

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So now we will kick things over to Rob, let me change the presenter here for you Rob. So you should now have control.

Rob Salcido: Can you see my screen okay?

Ian Blanding: Yes, we are seeing your screen.

Rob Salcido: Okay, great. Thanks, Ian. And thank you everybody and welcome to this webinar today for what's new in Residential Provisions of the 2021 IECC. My name's Rob Salcido, I'm with PNNL and I'll be leading you through the webinar today. Todd Taylor will be assisting me at the end with questions and answers and probably will be critiquing this at the end so hopefully, I'll do a good job in his eyes.

So here's what we have in store for today, I'm going to go through a little bit of the overview of the IECC structure. Many of you may already know this and are very familiar with this so we'll have just a brief overview just in case anyone is not as familiar.

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And then we'll go over the summary of what's changed between the 2018 and 2021 IECC.

There's been 118 approved changes that will go into the 2021 IECC. Actually, four have been removed on appeal so actually there will be 114 approved changes going on in the new code. I was considering having a painstaking discussion on each one of these but I don’t think I would finish before your Thanksgiving turkey got cold so we'll just go over those briefly.

And then we'll show kind of the spread of what the changes are and the administrative, energy related based on their impact. And then we'll get into a little more detail in focusing on the components, what changes affect what components in the building from envelope lighting, HVAC, service hot water, performance-based approaches and the appendix RB that describes zero energy homes.

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So we'll go from a very high-level view down into more specifics as we go along.

So let's start with the structure of the IECC. So the first question is why do we care about the IECC? What's important in this realm? And so, what it does is it guarantees a minimum level of efficiency in new buildings and renovated buildings. So it assures that we can see energy reductions, energy efficiency improvements, as well as emission reductions over the life of the building.

Energy codes are a subset of the building codes, which describe the requirements for building construction. And there's a cost, additional cost benefit with codes is it's much more cost beneficial when we build in energy efficiency at the beginning of the cycle of the construction as opposed to bringing in high efficiency in an existing building, it's much more costly.

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So if we can guarantee that the efficiency is designed and built into a new building then it's much more effective in a building lifetime.

So we look at commercial and residential sections of the IECC and we have similar chapters. We have a chapter for the scope and application, administration and enforcement, and definitions. We have general requirements. And then we have the efficiency chapters and this is where a majority of our discussion we'll land in today, which defines how to comply with the energy code and the different pathways that you could choose to show efficiency compliance.

And then there's a chapter for existing buildings. Chapter six is for reference standards that are listing within the chapter four and then appendices and the index.

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So this is kind of the structure and outline of the code overall, but we'll specifically be looking into chapter four, which is, again, describes the compliance paths.

So talking about chapter four this is where we get into details on compliance pathways. The first one is the prescriptive pathway; it describes the prescriptive requirements of the envelope itself. So this will describe what the roof insulation, the wall insulation, foundation insulation, R values or assemble U factors are to be. It also lists out the U factors for windows, doors, and skylights. The solar heat gain coefficients for the windows and air leakage and duct leakage rates.

So these are listing the prescriptive requirements and I'll talk a little bit more about in a little more detail about the pathways as we go along.

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But this is where the prescriptive requirements are described.

There's another section in chapter four that describes more performance-based alternatives to compliance. One is a performance compliance, which looks at annual operation of the home and then there's the energy rating index, which is kind of an asset rating that describes the energy efficiency of the building itself. So there are specific ERI ratings that a home much reach in order to show compliance. And we'll get into a little more detail here shortly.

And then, throughout the chapter it describes mandatory requirements. And these are requirements that cannot be traded off, they must be met in their entirety or the building will not comply. Even it could be the most efficient building showing the performance is well under compliance or the prescriptive requirements are very good, unless these mandatory requirements are met the building will not show compliance.

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So we got infiltration control, duct insulation and ceiling, HVAC controls, piping and insulation, equipment sizing, dampers, and lighting. So all of these will have mandatory requirements that will need to be met.

And so, some terminology I'll be throwing around throughout the webinar is first is prescriptive. And these are component specific requirements that can or cannot be lessened or eliminated in trade for compensating improvements elsewhere. So I'll talk about in the next slide where there are prescriptive requirements that are absolutely mandator to be met and there are some that could be traded off in other places within the envelope.

The performance in the ERI, the energy rating index compliance path is take the annual performance of the home and compare it to a standard reference home. Now this standard reference home is primarily set based on the prescriptive requirements and some operational requirements in the code itself.

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So we're comparing a home, the annual performance between the design and the standard reference.

And then again, like I said earlier, the mandatory requirements these cannot be traded down in a compliance path. So these are absolute mandatories that must be met.

And one thing I'd like to note when we talk about performance path is, as I mentioned, the performance path is taking the design home and comparing it to the standard reference home, which is based on the prescriptive requirements of the code. The ERI path is comparing the design home to a standard home that is part of the resident standard 301. That standard is based off the 2006 IECC. So your design home for the ERI is compared to more of a 2006 IECC level home to come up with the ERI rating.

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So we'll talk a little bit more about the compliance pathway option. So there are actually three options with the prescriptive requirements that you can show compliance. One is an R value prescriptive requirement. So basically, this is saying that your R values in your envelope meet the prescriptive requirements, point blank. If they do, great. If one envelope component does not meet that R value, the building does not comply. So it's a very easy to show compliance with this, you can have a hand checklist or a spreadsheet. You can show that the home meets R values and the home complies.

There are U factor and UA tradeoff possibilities where if you're looking at the U factors of the envelope you can trade of assembly components within that component U factor.

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So in the walls you can create any wall assembly but as long the U factor for that wall meets the U factor requirements then that wall complies but it must be all through the buildings. So the walls, the roof, the floors must meet the compliance U factor.

There's a UA trade off compliance path as well. This gives a little bit more flexibility where you can trade off UA values between envelope components. So you may have a wall insulation it may not meet the prescriptive requirements but you have a roof insulation that's well about the prescriptive requirements. So the UA for your ceiling you can trade off some of that benefit to the walls and as long as the building UA, your design building UA is less than or equal to the UA of the standard reference home then that building will comply.

So coming over to the simulated performance compliance path, which adds a little flexibility in your design this is taking now instead of just a compliance checklist we are looking actual annual performance.

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So this requires code compliance software to model your design home and compare that design home to a standard reference home, which is based on the prescriptive requirements as well as operational performance requirements that are set in section R405 for the performance-based approach.

And then it will take the annual energy consumption or cost of your design building and it must be lower or equal to that from the standard reference design. So as long as its lower cost then this building complies. So you have a lot of trade off flexibility within the simulated performance path ‘cause you maybe have a really high-level envelope and maybe you have a little less on your air leakages or you can trade off performance.

So there's a lot of flexibility here. And this accounts only for space heating, space cooling, water heating, and ventilation energy.

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This does not account for any kind of lighting and appliance loads, just for those regulated loads I mentioned. Also, renewable energy

cannot be used to boost the performance of the design building so that is outside the parameters of the simulated performance.

And finally, we have the ERI, the energy rating index compliance pathway. So what is going on here is your design home, similar to your design home for the simulated performance is going to be compared to the ERI reference home. The ERI reference home is based on the standard 301, the resident standard 301, which is similar to the 2006 IECC home.

So you're going to get a score based on the 301 standard has a methodology based on the normalized modified end use loads, which helps with fuel neutrality.

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It has a process to calculate the ERI based on the design home. So the ERI is going to be a value from zero, which represents a zero energy home to 100, which represents a 2006 IECC compliant home. So any code within there is going to have a lower than 100 score. So the lower the score, the better the home.

In the 2021 all the IECCs they have specific ERI requirements to show compliance. So this ____ home has an ERI that's equal to or lower to the ERI targets within the code itself and this home complies.

So where this design flexibility increases is now the ERI does account for lighting and appliances where the simulated performance does not. So you could use high efficiency lighting and appliances to trade off for to get a better ERI rating. In addition, you can use renewable type energy, onsite renewable energy to boost your ERI to show competition.

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So again, going from the prescriptive level up to energy rating index there's more complexity in showing compliance but there's allow more flexibility in showing compliance.

So I think, Ian, you wanted to do another poll right here?

Ian Blanding: Yeah. We've got a couple more polls, let's see if I can launch them. There we go. So if you guys can fill this out, we're just trying to gauge level of experience with the energy code and then we have another poll after this to determine which energy code is in effect in your jurisdiction. So I'll give it just a couple more seconds here.

All right, I'll close that and share it.

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Yeah, so good audience I think for this discussion and good background information that Rob is covering for some of the folks that only been in the energy codes world for one to five years. But it looks like we also have some more experienced folks on the line as well. So that's great to see.

And so, bear with me, we'll just do one more poll. And this is, as I mentioned, related to which energy code is currently in effect in your jurisdiction. And understanding that there are amendments that have been incorporated but which base code actually is in effect? All right, just a couple more seconds here.

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All right and we'll share the results. That's great somewhat surprising on my end. It's great to see that newer codes are really in effect at least for those that are in the audience. Hopefully, some of those jurisdictions are considering the 2021 IECC so staying on that update cycle.

So Rob hopefully that provides some additional context for you as you continue through your presentation.

Rob Salcido: Thanks Ian. Is my screen still up?

Ian Blanding: Yes, we can see it.

Rob Salcido: Great. Okay, thanks for that. And so, continuing on just with, hopefully, somewhat of a better understanding of the IECC we can now focus on what is going to be coming in the 2021 IECC.

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So as I mentioned before, there are 114 accepted proposals for the 2021 and they range from, as you can see, 58 percent are administrative and then the rest have some kind of energy impact. And we've rated these impacts based on a combination of our professional judgement as well as what is accounted for in our established methodology to determine the impact of these proposals. So this kind of fits into what we'll talk about at the end is our determination study that we used to determine what is the overall impact of the combined proposals on the overall energy efficiency of the 2021 IECC.

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So as you see here, 66 administrative changes to the standard, which, as you can see, a majority of them are editorial process changes, clarifications, definitions, adjustments, and amendments. So these really don't have much of an energy impact but are kind of clarifications and updates to the code.

You can see I've highlighted two in red over here, RU 147 for electric readiness and the one for EV charging and readiness. These two were removed on appeal by the appeals board so those won't be part of the 2021 IECC standard.

These sets were deemed to have either minimal energy impact or increase energy consumption. You know when you think about this minimal impact or increased energy consumption there could be arguments that in certain cases that these could possibly decrease energy consumption or have more of an impact.

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But like I said, based on our established methodology these are where these proposals fit into place. I will be discussing quite a few of these as we move forward.

And then finally, we have 24 proposals that will definitely be decreasing energy. And again, I'm showing two here one is the advanced continuous burning pilot lights and the other that increases hot water efficiency Those were removed on appeal as well so we ended up with 24 proposals that will be going into the 2021 IECC that will help reduce energy and basically, increase the efficiency.

So, without further ado, let's look at kind of the components themselves of the buildings and see what's going to be changing.

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So RU 29 basically this says increase R value of the wood frame insulations in climate zones four and five. And so, you can see here basically adding R 5 insulation to the heating. So as opposed to 20 there's 20 plus 5 or 13 plus 10 for climate zones four and five. So this will definitely in those climate zones help increase energy efficiency.

And then for slabs, we got us some new slab insulation requirements. One being for climate zone three. Previously, there was no requirements for slab insulation in climate zone three and now there's added in R10 at two feet of depth for perimeter slab insulation. While in climate zone four and five they've kept the insulation the same at R10 but now increased the depth from two feet to four feet. So matching up what's in climate zone six through eight for those.

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So that will definitely help in the heating season for the energy consumption. It might show, especially in climate zone three it might show a little increase in cooling consumption but overall, there be total energy reduction there.

So for ceilings we've got two proposals affecting different climate zones. So for climate zones two and three we're going from an R38 to an R49. And then in climate zones four through eight we're taking it from R49 to R60. So definitely increases that will benefit the energy consumption. So most all climate zones except climate one will be shifting in the 2021 IECC.

So then we've got three proposals that affect the window requirements.

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As you can see in climate zone two, we're going from a U factor of 0.4 to 0.35. And then in climate zones 3 and 4A and B going from 0.32 to 0.3 so definitely improving the stringency of the window U factors.

Also, for R37 is adding a solar heat gain co-efficient requirement of 0.4 for climate zone 5 and 4C. And then there's another requirement down here, which is possibly has an energy impact of increasing energy consumption where we're specifying an allowance of a U factor of 0.32 in climate zones 4C up to 8. For homes above 4,000 feet elevation or in wind born areas you can have a wind factor of 0.32 rather than 0.3.

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And this is just for in those harsher climates its hard to get even lower U values especially based on the pressure differentials or the structural protection for these windows. So that's the reasons

behind this proposal of allowing a U factor of 0. 32 rather than 0.3 in these locations.

And this one, this is where we have backstops for windows in the code and this is one of the mandatory requirements where even though you have prescriptive requirements for the windows and for allowing for trade off you still have to meet a maximum U factor. An area weighted maximum U factor or solar heat gain co-efficient.

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So in climate zones four and five it's going from 0.48 to 0.4 and then from. 4 to .35 in six through eight. And then for the windows the solar heat gain coefficient is going from 0.5 to 0.4. So this provides the mandatory backstop for your windows. And the reason behind this is since the early codes, this hasn't changed at all while prescriptive U factor and solar heat gain requirements have dropped over the years. So they've improved but this backstop has remained the same for all these years So this change effectively kind of better aligns the backstop to what the current prescriptive requirements are for U factors and solar heat gain coefficient. So this one has been in its time coming.

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And there were two proposals that kind of added additional assembly possibilities for the walls and basement walls. So originally you could use R15 continuous insulation or R19 ____ insulation. And you still can but now we've added a possibility that you can use R13 ___ insulation combined with R5 continuous insulation. So this is in climate zones 4C through 8 for the basement walls. It doesn't really affect energy consumption just it gives different prescriptive allowances for different assemblies.

And the same with the wall requirements where here it gives the option where you can have zero cavity insulation and provide all your insulation on the sheeting or the exterior so it's continuous insulation.

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So this provides just different options that you can use in the prescriptive performance for showing compliance.

Another ___ of change is for under the performance compliance now that it allows infiltration to be at 5.0 ACH 50 so it allows

tradeoffs based on your air leakage in the design home. So the prescriptive requirements if you're going through a prescriptive performance path you still if you're in climate zones three through eight you still need to meet three ACH 50 infiltration requirements.

But if you're going through a performance path you can as long as your home is less than as long as your air leakage is less than 5 ACH 50 the home will comply and meet the requirement.

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And it allows the design home to get trade off credit for lower infiltration, for tested infiltration.

So if your design home had a 3 ACH 50 you could use that benefit to trade off with other components in the building. So you might have a little less envelope efficiency that could be covered by the better, tighter home so your infiltration would gain that credit. So just the important piece is if you're doing the prescriptive competition the air leakage have not changed.

So those were the envelope changes. We'll go through some of the lighting changes that you'll see in the code.

So there were two proposals, RE7, RE145 that increased the efficacy in the definition of high efficacy lamps.

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RE7 specifies that lamps must have 65 lumens per watt and keeps the percent of lighting at 90 percent maintaining that 90 percent of your lighting must consist of high efficacy lamps. Where RE145 states that the lamps shall have 70 lumens per watt and that all lighting in the home will be high efficacy lighting.

So it will be interesting when the published version of the 2021 IECC comes out how they combine and harmonize these two proposals to come up with final language. So to be determined.

And then RE148 this specifies that all exterior lighting in low rise multifamily buildings must comply with IECC section C405.4 for exterior lighting.

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So this just governs the allowances for exterior lighting based on location so for specified area like parking, façade, entryways, etcetera. So this now has allowances based on where the exterior lighting is located.

And then for RE149, exterior lighting controls this is basically mandating that any connected, permanent exterior lighting greater than 30 watts must have some kind of control. You can pick one of the four of a manual on/off switches with automatic shut off, photo sensor controls, a timer switch, or any kind of automatic shut off that allows an override so that it returns to normal operation within a 24-hour period.

These are the lighting changes. Definitely these will help reduce energy consumption in lighting.

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The RE148 it will be a to be determined if that's true based on what the lighting was before and what requirements are now for C405.4. So I could see arguments that it could go either way.

And now we'll talk about some HVAC changes in the 2021. So in the past, duct leakage testing there was always an exception if you had ducts in condition space that you did not need to duct test those ducts. That exception has been removed so now no matter where the ducts are located, they will need to be tested with a duct blaster.

And the reason behind this is that even though all the ducts may be an inside condition space and there wouldn't be probably zero to very little duct leakage outside that there could be comfort issues.

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If you had installed very leaky ducts inside the space that the spaces on the far end on of the duct run will not be getting the required air flow and there could be comfort issues.

So the argument here is that this will reduce callbacks and improve comfort and balancing within the building itself. So it's a performance and comfort issue, probably will not have any energy impact or minimal energy impact but this will probably affect builders and those who do the duct testing where they usually had the exception now, they're going to be testing those ducts. I think this is a good thing that this is in place.

And we got some mechanical ventilation requirements.

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RE130 now mandates in the code that mechanical ventilation systems shall now be tested and verified that they provide the

minimum flow rates based on the building itself. So there will be some kind of a verification that the mechanical ventilation systems are meeting those minimum flows.

We also have some increases to the efficacy based on the type of fan. So inline fan went from 2.8 to 3.8 CFMs per watt. Bathroom fans based on the flow rate went from 1.4 to 2.8 CFM per watt. And then if it's 90 or above then it went from 2.8 to 3.5 CFM per watt. So increasing definitely helped reduce energy consumption there for ventilation fans.

And then also, there was a newly added section for integrating air handlers or the air cycler systems that these must meet 1.2 CFM per watt.

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So RE139 now for prescriptive path only it's going to require the mechanical ventilation in climate seven and eight are to be provided by an HRV, a heating recovery ventilator or an energy recovery ventilator. There was a study done at PNNL that showed that these units can be cost effective in climate zone seven and eight so that was the reasoning behind this proposal and it was accepted.

So this will definitely for those two climate zones having an ERV or HRV over a standard supply only or exhaust only will definitely help reduce energy consumption for the ventilation piece.

So those were the HVAC changes and now we'll look at the service hot water changes that will be going into this 2021 IECC.

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So RE16w so this proposal adds a compactness factor to the performance path for hot water usage. So in the past, basically. The only way to show energy savings in the service hot water was to have a high efficiency hot water heater. And there was no way to incorporate compactness of the design or just how centralized was your water heater in relation to the fixtures in the home.

So now this kind of incorporates benefiting compact design in the home for a compact water distribution system as well as having a centralized hot water heater.

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So the original equation for determining what is the hot water demand on a daily basis was the standard 10 times the number of bedrooms plus 30 and that would be your gallons per day for the home

So in a proposed design we're going to adjust that equation by incorporating the compactness factor. So here it shows various levels of the compactness of the distribution system. The higher the compactness, obviously, there's no benefit but as you become more and more compact in your design based on your home then this factor will come into play and reduce the gallons per day in your design home so you can show savings of this in your performance path.

So here's how you specify the compactness factor. So first thing is you locate the water heater and that's signified by this red dot.

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And then you draw a rectangle through the center line of the water heater and the plumbing fixtures along the wall. So in this case, since we've got a fixture along this point of the wall and in the kitchen along this wall the square is going to come outside this water heater so that's the reason it's not in through the center line of this water heater. But this is your area of your of your hot water distribution system.

So we calculate the area of this square, this rectangle and we know the area of this condition floor area so you're going to divide this compact area by the total area and that's going to give you your compactness factor. And then you can see is that low enough to take advantage that you can calculate that your proposed design will have a lower hot water consumption in the gallons per day.

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So I can show you how this can benefit. So let's take the case where we have – and I apologize if these aren't super clear but you'll get the idea. We got a home where the water heater is in one corner of the garage and we draw the square that encapsulates all the hot water distribution system. So in this place we have 1,140 square feet of floor area in this home and our hot water system rectangle is 828 square feet.

So dividing that 828 by 1147 we get 72 percent compactness factor, which we don't get any credit for that it's just too high of a compactness so it's not going to get credit. Now if we want to just

move that water heater to the other corner of the garage where it's closer and makes it more compact and centralized now, we have the same square footage in the condition floor space but now we have 575 square feet of this smaller rectangle.

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So now our compactness ratio is 50 percent and we get five percent reduction in your hot water usage so we can take credit for that in a performance path. So this proposal will really help incentivize that this compactness of this whole hot water distribution system.

So another proposal that's similar in scope in effect towards the how water consumption is just adjusting the equation for hot water gallons per day. In the past, like I said, it was 10 times the number of bedrooms plus 30, now it's 25.5 plus 8.5 times the number of bedrooms. So this is basically, probably a 15 percent reduction in hot water gallons per day for the propose home. And it's the same in the reference design.

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So while this shift will reduce the consumption for hot water it's going to be the same for the standard design as well.

So there's going to be no real benefit. You're not going to get credit for this because the reference design has the same hot water demand but it does shift down the overall energy consumption for both designs so it makes it a little more to actual hot water schedules in homes. And this equation has not been updated since 1998 so it's good that this is becoming more realistic with what homes are seeing as far as hot water consumption.

So let's talk about some performance ERI changes. The big one here is that the climate zones will be shifting.

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So as you see on the left here this is the climate zone map that's been used in the IECC for some time since it's inception and has climate zones one through eight spread out throughout the country. And ASHRAE 90.1, 90.2 we're using the climate zone map at a standard 169 2013.

So what the result of this is 10 percent of the climate zones were in different climate zones. Let me say that again, 10 percent of the counties in the US had different climate zones. So with the IECC

adopting 169 2013 we're going to be using their climate zone map for the performance approach in annual performance analyses.

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So you can see here that there's some new climate zones. We have climate zone zero, which basically aren't in the US but those are extremely hot climate zones.

But there is an additional, there's climate zone 5C, which is a new climate zone for cool marine and that is basically up here in the Seattle region for that climate zone. So what this shift essentially does is there's a lot of counties in the country that will be shifting to a milder climate zone. So basically, it's going to have less stringent prescriptive requirements in those areas.

So as you can see, the greens represent counties moving to colder climate zones and the reds are counties that are moving to warmer. So the green counties will have more stringent prescriptive requirements while the red counties will have less stringent prescriptive requirements.

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So this will play into what is the effect overall in a national level of what is the impact of the *[inaudible]*

On the ERI side there's two proposed backstops. The first one, RE150 is setting the ERI envelope backstop to 115 percent of the 2020 IECC reference UA. So earlier on we talked about for a UA prescriptive approach that the proposed design of the – the UA of the proposed design much equal the UA of the prescriptive design and then it complies. Well on this case just as a backstop for the EERI we're allowing the 15 percent boost on the prescriptive reference design.

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So this is just a backstop in the ERI compliance path that making sure that the envelope meets this backstop. That it's with 15 percent of the prescriptive reference design UA.

And there's also a secondary one from RE 182 that sets the backstop to the 2018 IECC when using onsite renewable energy. So if your design home has onsite renewable energy then the compliance, the backstop for the envelope so it's basically saying he UA of your proposed design must equal the UA of the 2018 IECC prescriptive design.

So again, there's a lot of overlap on these, it will be interesting to see how the final version of the 2020 IECC melds these two together to come up with either a dueling or a single envelope maxed out for the ERI.

[0:49:00]

Another envelope backstop is for the performance path. So this is the first time that the performance path will have a backstop. In previous codes there was no backstop in the performance path so you could have a poor envelope and cover that with other efficiency values within the building design to meet the requirements. In this case now the envelope backstop is the 2009 IECC.

So typically, in your performance software you're going to do a UA check where making sure the UA of the proposed design meets the UA of the 2009 IECC that's the simplest way to show that kind of compliance. So now the envelope must meet that level of stringency for the 2009 IECC.

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In the performance path now there's a section in Table R405 that that specified humidistats. So starting to think about latent loads and the latent load recovery. So this is setting humidistat requirements for the reference design and also, in the proposed design these are the very same requirements that it must meet. So similar to what I mentioned earlier with the hot water where the hot water demand was changed in both the proposed design and reference design. Similar here where you're going to have similar settings for the humidistats in the proposed and reference design. So this is bringing into account now that the annual energy consumption will be accounting now for the latent loads in the house.

[0:51:00

I think right now this will help encourage software providers, compliance software providers to account for the moisture in the home. So I think we'll see future advancement of this in future energy code cycles.

And another that accounts for the ERI is that there is now going to be a cap on how much renewable energy that can be used in the ERI calculation. In past cycles you could have a standard home, a

substandard home that may not meet the performance requirements, the simulated performance requirements but then we could just throw a huge PD system and then that home would comply in the ERI pathway.

[0:52:00]

So this sets now kind of a cap on renewable energy to five percent of total energy use. So this kind of helps ensure that there's a good envelope and HVAC and air leakage design in the home and not relying completely on renewable energy to lower the ERI. So this places a limit on how much credit that onsite renewable energy can provide.

So in the 2021 IECC the ERI targets are going to be set back to the 2015 ERI targets. So if you look at the 2015 levels, these are the from 52, 54, 55, 53 so we're setting the 2021's back equal to those values. The 57, these numbers were what in the 2018 IECC.

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So the scores were increased because the changes in the code that reduced the ventilation requirements in the ERI reference home and in so doing, the result of that was they increased the ERI scores significantly from it could be five to 10 points in some case. And so, it made it harder to get down to the level of the 2015 ERI targets.

So now at the 2021 IECC is going to be set back to those targets it will be harder to meet those targets with the ventilation requirements of the reference home intact. So that will be interesting to see how many homes can meet those 2021 ERI targets.

[0:54:00]

And so, another big proposal that's going to help increase energy efficiency is RE 209, which is adding in additional efficiency option packages. So this is similar to the commercial IECC portions of the code where there are options that are required to be chosen that would increase efficiency of the building.

So in this case there are five options that the primary goal is to increase efficiency of five percent beyond the prescriptive requirements. So option one is an enhance envelope performance option where basically the design UA now has to not only just

meet the standard UA but has to be five percent below the standard UA. So .95 times the standard UA is the requirement.

Option two is efficient HVAC equipment performance where you have a furnace of 95 percent AFUE or better.

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And a 16 SEER air conditioner or better or an air source heat pump with a 10 HSPF and 16 SEER or a ground source heat pump of greater than 3.5 COPD.

So, option three could be a reduce energy in your servers' hot water so you're having higher efficiency water heaters, .82 Efficiency for oil or gas water heaters. Electric must me 2 or 2.0EF or greater, which is probably a heat pump water heater level. Or a solar water heater with greater than .4 solar faction.

You can have ____ for more efficient ducts. So basically, that 100 percent of your ducts are inside in the building thermal envelope or inside condition space or you have a ductless or hydronic systems so no thermal distribution.

And then a final option five is improved air ceiling and efficient ventilation.

[0:56:00]

So as long as your air leakage is before 3.0 ACH50 and you have HRV or an ERV either 75 percent sensible recovery efficiency or for the ERV 50 percent latent recovery moisture transfer efficiency then you've met the requirements.

So picking any one of these five is mandatory, it is not something that can be traded off but you need to prove that your home has one of these five options.

And then finally, Appendix RB for zero energy home this basically allows jurisdiction to adopt a model and a standard for zero energy home designation. This is not a requirement unless a jurisdiction adopts and make this appendix part of their code then this would be a requirement. So basically, it shows the pathway to prove that this is a zero-energy home where you have two ERI scores based on your climate zone.

[0:57:00]

So you'll have an ERI without onsite renewable energy so this is basically reflecting that based on these levels in the 40's that you have to have a very efficient design in your home. The envelope, the mechanical systems they need to be airtight. Efficient lights and appliance and you first meet these stores and then you supplement that with enough PV that your final ERI is a zero. So in that case then you have a truly a zero energy building based on these requirements. So if a jurisdiction does not specifically mandate or accept this part of the code then it is not required.

So those were all the changes that we felt had the most impact on energy consumption.

[0:58:00]

As you can see if you look that this map here the percentage of state populations that are going to be moving to warmer zones based the climate zone changes you can see North Dakota, Texas, North Carolina, Wisconsin, these are the ones that are going to be seeing the major shifts, the most shifts based on population areas and population density where these climate zone shifts occurred. So this will be interesting to see a final result when we do our final determination stage to see what is the overall impact on the 2021 IECC.

And we have plans to implement the 2021 IECC into our REScheck and COMcheck software next year, in the spring for REScheck and in the fall for the COMcheck offer so keep an eye out for those.

And with that, I will take on any questions that you have.

[0:59:00]

Ian Blanding: All right, thanks for that Rob, let me just take control real quick and while I do that, please continue to put questions into the question bar. So we do have a number of questions that have already come in so let me start going through those.

Okay, so let's start with kind of the development process of the IECC. There's a question on how do you access the residential amendments that were submitted kind of prior to the 2021 IECC publication? So where can you find those proposals that were submitted?

Rob Salcido Todd, I imagine those are in the IECC website in the code hearing section?

[1:00:00]

Ian Blanding: Todd might not be fully online yet. Todd, it looks like you're muted if you're trying to talk. There he is. There you go.

Todd Taylor: Are we better now?

Ian Blanding: I can hear you, yep.

Todd Taylor: Oh, good. Okay, yeah, the ICC website is called ieccsafe.org. ICC is all about safety so ieccsafe.org and follow the menus through the code development section and you can get all of that information for multiple code hearings going back through the years even. So yes, it's all out there, it's quite voluminous.

Ian Blanding: Excellent. And there's a number of questions about whether or not the slides are available. They are available at energycodes.gov and I will put that link into the chat but they are currently available.

[1:01:00]

Let's see, next question, so this is windows, and Rob, you might not be able to answer this I can potentially help out if possible. When does ____ project to issue a determination on the 2021 IECC? So Rob, any thoughts, otherwise I've got at least –

Rob Salcido: Can you repeat the question?

Ian Blanding: Oh, sorry about that. Windows DOE projects to issue a determination on the 2021 IECC?

Rob Salcido: Oh, we're hoping that that will be coming out, I'd like to say in the March timeframe. We need to wait for the published version of the 2021 IECC to make sure that we account for what's in the actual published code.

[1:02:00]

So the sooner that comes out, yeah, we can, but I think still, in a March timeframe is what we're looking at.

Ian Blanding: Yeah, and I'll just note that statutory timeline is 12 months from when the IECC codes has been officially released. So it's, hopefully, at least going to be within that window.

Todd Taylor: This is Todd, I'll just comment on that. The March timeframe that Rob is referring to will be in ____ and there will be an opportunity for public comments on that. And then the final, I would generally you can expect the final is pretty close to that one year timeframe, it's pretty hard to fit the comment period in there with any shorter than that.

Rob Salcido: Yeah, good point.

Ian Blanding: Excellent. Next question we'll move to the envelope section of the code.

[1:03:00]

So for wall insulation does a double stud wall meet the continuous insulation requirement or must it be exterior insulation?

Rob Salcido: On a prescriptive level I would imagine so. Without knowing any other details on it, if the continuous insulation if it's unbroken by any studs that R value needs, you know – I could say the minimum R value that's continuous in that wall should meet those requirements.

Ian Blanding: Yeah, I would say as long as there's staggered studs in some way and that is broken I would think that would work.

[1:04:00]

Todd Taylor: This is Todd again, generally speaking, if you're complying by the R value tables you need to do what's in the table. But you're always free to go to the U factor table to build an equivalent wall it could be a double stud or whatever.

Ian Blanding: Excellent. Another question on insulation and we haven't done any full modeling on the code yet but the question is, in your opinion, does R60 in the attic represent optimal cost benefit and at what point does adding more insulation and costs outweigh the energy savings?

Rob Salcido: That's a good question and I don’t know if I can find a solid answer.

[1:05:00]

At what point do you get to the diminishing returns where the cost is significantly to increase the insulation but the energy

consumption benefit is getting lower and lower. I know that the proposal, the folks who did the proposal on it did some financial analysis but we have yet to do our own in our determination study. I don't know if I can find a definitive answer, I'll just say yes, 60 is it might be bridging on that point but I don't know. Todd, what do you think?

Todd Taylor: I haven't done the analysis so I can't answer until we do that analysis and it's going to vary from place to place, obviously.

[1:06:00]

So I would say the jury is still out analytically.

Ian Blanding: Excellent. So moving on to lighting here so there's a question on interior lighting. So Rob you mentioned that there are the two kind of competing proposals that were voting in. The question is would the more stringent proposal, RE145 take precedence over the weaker proposal RE7?

Rob Salcido: Todd you have experience in these multiple proposals when they come out.

Todd Taylor: I would give a very solid I don't know. We're anxious to see how IECC coordinates those two but I really have no idea what they'll do.

[1:07:00

Ian Blanding: Okay, excellent. So now that duct leakage is required regardless of whether or not it's inside or outside the thermal boundary what is the duct leakage target for that now? If you could kind of reiterate what that is.

Rob Salcido: The duct leakage target remains the same. It's a total duct leakage test so based on, you know, if the air handler is installed or not so based on the timing of the test, they remain there was no change in those values.

Ian Blanding: The values remain the same but it is prescriptive still, right, that can be traded off is that correct?

Rob Salcido: Yes.

[1:08:00]

Ian Blanding: Okay, moving on to water heating it looks like we have a couple questions on that. So how is the hot water distribution compactness factor analyzed if the hot water heater is on a different floor level than the fixtures does it also have a height component in that analysis?

Rob Salcido: It does. Yeah, in the footnotes of that table not it describes that you add additional area. Let me see if I can find it real quick ‘cause I have it as part of some of my slides.

[1:09:00]

Ian Blanding: I can also potentially pull it up.

Tony Taylor: While Rob is looking for the slide, I believe that the number of stories is accounted for separately from the size of the rectangle. Isn't that right, Rob?

Rob Salcido: Right, it's in the table, one story versus two or more stories, it has different compactness requirements.

Tony Taylor: I think maybe the answer to the question is the rectangle is the same you're just looking down on the building but the threshold that they're targeting differs depending on how many stories there are.

Ian Blanding: Excellent. Another question on water heating.

[1:10:00]

For residential water heating it appears the energy efficiency metric is measured in EF when UEF is the efficiency metric for residential hot water heaters and DOE labeling requirement as of 2017. I guess that's the question is, is it EF in the code and UEF elsewhere or how is that label?

Rob Salcido: I noticed that as well and I took the EF straight out of the proposal language so there may need to be clarification when it comes to a published version is did they mean the UEFs and that's what will be in the proposal or do they have to kind of shift those to account for that it was EF and what would be the corresponding EUF? But that is the language straight out of the proposal so again, once we see the published version, we'll know for sure.

Ian Blanding: Okay. So there's just a couple questions, there's a few questions on when IECC or the 2021 IECC might be released.

[1:11:00]

So based on ICCs website it looks like it will be available sometime in December. So there's some questions given the appeals process and how that went is that going to push back the timeline? But ICC is saying it will be available sometime in December.

And then Rob, I think you mentioned this but just to reiterate a question on when will REScheck support the 2021 IECC desktop version or if it will?

Rob Salcido: Yes, the goal is to in May of next year to have REScheck and then COMcheck by October. Those are our plans, we'll see.

[1:12:00]

Those are our goals.

Ian Blanding: Okay, excellent. So there's still a question on what is the total duct leakage target. So the target is four percent, is that correct?

Rob Salcido: yeah, so I just had that open and I closed it again.

Todd Taylor: I actually believe it's 4 CFM for 100 square feet at 25 _____.

Ian Blanding: Yep.

Rob Salcido: It'd be three if the air handler is not installed.

Ian Blanding: Yeah, exactly. Any additional questions? It looks like we've gotten to all of them. Hang on, there's one here that I apparently missed.

[1:13:00]

Does the zero energy appendix allow offsite renewable energy generation to count toward the ERI score of zero?

Rob Salcido: It mentions only on-site energy it does not say anything about offsite so I would have to say no. I mean I know that there's talk of, you know, in certain code cycles I've heard discussions about allowing. Where it becomes difficult is if you're in a multifamily building where there's just not enough room for onsite renewables but there is ____ offsite. But at this time, looking at the language it just mentions onsite.

Ian Blanding: Okay, excellent. So I'll give it a couple seconds here if anyone else has any more questions but I have a question for Todd.

[1:14:00]

So given your vast experience with the residential IECC development process how does this year compare to previous years in terms of number of changes, level of improvement? And that is the jury is still somewhat out on level of improvement given that we haven't done the analysis but just curious if you have any sense of one kind of how this year compares to some of the other cycles?

Todd Taylor: Well, this is a pretty big year both in terms of the number of changes and I believe we will find in the magnitude of the changes. Historically there were some very large improvements in efficiency between '06 and '09 and between '09 and 2012. But since 2012, through 2012, 2015 and 2018 were very, very modestly improved. So those code cycles were small increases in efficiency.

[1:15:00]

This one will be larger than those, whether it compares to the '09 and the '12 codes in terms of improvement, we'll just have to wait and see.

Ian Blanding: And then last question that came through is PNNL or another entity compiling the cost and savings data associated with this code change? So Rob, if you want to speak to that a little bit?

Rob Salcido: Ask it again?

Ian Blanding: So basically, is PNNL going to do a cost benefit of this code and that's obviously something that we do but I was hoping that you could speak a little more to it.

Rob Salcido: Yeah, one of the analysis we do is a determination study, which just basically, you know what is the impact of the code itself over the previous codes.

[1:16:00]

And so, is it more efficiency, less efficiency and there's also as part of that a cost effectiveness approach? So then we look at of the measures that we incorporate into the study what is the cost? And so, we will be doing a lifecycle analysis. Let me back up,

what is the installation cost for those measures, how much it increases the construction cost? And then we do a lifecycle analyses based on that with the cost savings based on those higher efficiency measures. So we will be doing those two analyses.

Ian Blanding: Excellent. Last question before we wrap up, this is related to the performance path. Does the simulated performance method account for building orientation?

Rob Salcido: Yes, it would.

[1:17:00]

So as long as the model accounts for that as well, the compliance software tool. So as long as it can orient it correctly and then take account for the solar insulation on a window, yeah, it will account for that. It should.

Ian Blanding: Right, right, yeah. I appreciate all the questions from everybody. Thank you to Rob and Todd for enlightening us and providing that great presentation.

So just a reminder that the NECC seminar series is continuing and we hope that you'll join us next Tuesday. Again, this is kind of a special edition, a late addition to the NECC line up but you don't want to miss it. It's going to be kind of a combination of IEA as well as DOE talking about energy codes around the world.

[1:18:00]

And again, that starts at 10:00 AM Eastern so hopefully you can join us for that.

And then we've got a great line up that goes back to our regular scheduled Thursday at 1:00 PM Eastern after Thanksgiving.

So with that, thanks again everyone, for tuning in and we hope that you will join us again next time.

Rob Salcido: Thanks, Ian, Thanks, everybody.

Ian Blanding: Thanks so much.

Male: This has been the National Energy Codes Conference Seminar Series hosted by the Department of Energy. Join us each week for

a number of other important topics building energy codes just like todays.

[1:19:00]

We're here every Thursday afternoon at 1:00 PM Eastern. Participate live in our upcoming events or listen to past events on demand through our energycodes.gov training portal.

There you'll find other helpful tools and resources from education and training materials to compliance tools like our REScheck and COMcheck software to the latest on state code updates to analysis of energy code impacts from energy savings to cost effectiveness and more. Check out energycodes.gov for those and a number of other technical assistance resources from DOE, Pacific Northwest National Lab, and others.

From the DOE Building Energy Codes Program, we hoped you learned something new about energy codes and enjoyed today's session. Thanks for being part of the conversation and we'll see you next week.

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