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*Rosemarie Bartlett:* Welcome, everyone. I'm Rosemarie Bartlett, with the Pacific Northwest National Laboratory, and I'd like to welcome you to today's webinar on IECC compliance paths, which is actually the first in the U.S. Department of Energy's Energy Code Commentator webinar series that we're kicking off. A webinar will be held the second Thursday of every month at this same time, so keep watching on BECP's training page as topics get added. Hey, and if you have any topic suggestions you'd like us to consider, would you please e-mail those to me? My e-mail's in your webinar reminder messages.

Our speaker today is Shaunna Mozingo from Colorado Code Consultants, and we appreciate her taking the time to share information on the IECC compliance paths with us today. Shaunna, it's all yours.

*Shaunna Mozingo:* Thanks, Rosemarie. Again, this is Shaunna Mozingo. And hopefully today we're gonna talk about the energy code compliance path, how to utilize this code –

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to build the project that you want, and show you all the different paths of compliance to get there. So hopefully today we're gonna look at: what is the flexibility that's built into this code? How can we build the building that we want to, and still comply with the code? We're gonna look at how the prescriptive path comes in, COMcheck, REScheck – how does ASHRAE 90.1 fit into the picture? Energy Raters, different software tools – we're gonna look at all of these items to see how they play a part in the code, what kinda documentation we need.

Some of the objectives that we have today is: to look, again, at that flexibility and the variety of paths. How do we identify the prescriptive path, and the requirements that we need for that, and the documentation needed for that? How do we identify the UA alternative path, and where does REScheck and COMcheck fit into that picture? What are the performance paths out there, and what do those softwares have to do, and what kind of reporting do we need?

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So we're gonna hopefully look at all of these items today, and have a better understanding when we're done.

A couple of things that we have to do first is to learn how to actually use this code to navigate through it. So the code is broken up into commercial and residential chapters. This, in the 2015, we brought in a chapter five for both commercial and residential that ends up being the existing buildings chapter. So it tells you everything you need to do for code compliance for existing and historic buildings, and that's to the 2015.

Another thing we need to know before we can use the code is the difference between a commercial building and a residential building. I get a lot of confusion on this topic, especially when it comes to multifamily buildings. So the definition of a residential building that we're talking about is: anything that's built under the IRC, those one to two family dwellings and those townhouses.

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And then also there are some buildings built out of the IBC, R-2, R-3, and R-4 buildings. As long as they're three stories or less, they use the residential chapters. So you might have an apartment building that has to comply with one of those residential paths. And then everything else is a commercial building. So all those R-2,3 and 4 over three stories plus all of your other occupancies out of the IBC would be a commercial building.

What do we do when we have a mixed use building? We might have to use two different chapters of the code. We might use the commercial chapter for that bottom level that might be retail or business. And then the apartments above – and as long as the building is three stories or less – that would be using the residential chapters for those floors that are R-occupancies. Once the building gets to four stories or more, the commercial chapter is used for the entire building.

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So it's just important to keep in mind that little bit of a difference in bringing those R-2s into as a residential and not commercial if it's three stories or less.

Another thing we need to keep in mind is the actual scope of this code. A lotta times we think that it only applies to the building. But it also applies to the building site and any of those associated

systems as long as they serve the function of that main building. So that's why we see, in the code, requirements for the on-site renewables, or for pools, or for your exterior lighting. It may not necessarily be on or attached to the building, but they serve the function of that building, so they are requirements for those as well. It's just important to keep in mind those aspects.

When we get into the energy code, it feels a lot like a juggling act. How do we keep flexibility built in so we can build what we want to, still maintain the health and safety of the building, keep our building durable, save some energy in the process, and not hinder innovation and technology?

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These are all the things that we're looking at when we're writing this code. And looking at the requirements of the code, how do we maintain all of these things at the same time? So, as we go to the requirements today, you'll see that the flexibility built into this path is trying to take all of those things into consideration. One way of doing that is through alternate methods or materials. So we've always allowed alternate methods of materials as the code official decide that what you're proposing to do as an alternate method could meet the intent of the code, and he could allow it as an alternate method or material. New to the 2015, at least in the residential provisions, it says: you have to meet the intent of the code, but you also have to – whatever method or material you're using has to at least meet the equivalent prescribed value of the code too.

So there's this new organic mushroom insulation out there.

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If I wanna propose to use that, I have to give some substantiation to the code official saying that mushroom insulation will at least meet the R value of what's prescribed for my climate zone.

There's some flexibility by allowing above code programs. So I could say maybe I wanna use LEED for homes, or a commercial building. Or I wanna use ENERGY STAR, or I wanna use ICC-700, the national green building standard, or ASHRAE 189, or International Green Construction Code. These are all above code programs that are allowed. And the code says that if the code official chooses, he could allow those as meeting the intent of this code. But even if you use those above code programs, it's still

important to remember you still have to do the mandatory items in the code, which are things like equipment sizing and sealing your ducts and making sure your buildings are tight.

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There're still mandatory items in this code that have to be met. But if you use those other above code programs, all of the other requirements are deemed to be satisfied. So that's some good flexibility built in.

Let's start with residential. So residential: we have a few different pathways. But 2015 brought in a new pathway. Look at: how do we build what we wanna build and still comply with the code? First there is the prescriptive path. That's just: "Tell me what I have to do, and that's what I'll do." And then I go in there and I look back to the code section in 402 and determine: "What do I need to do for the building envelope?" I look in 403; "What do I need to do prescriptively for my mechanical? What do I need to do for lighting?" And we just walk through the code and find out what we need to do. So there's a R-value table that I can use. But there's also a U-factor table that I could use. And there's performance approaches, or a UA alternative approach that we can use as well.

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What are those and how do I navigate through those to get to my end result that I'm after? Let's look at that. So here's the R-value table. This is that table that just says, "Okay, if I wanna go prescriptive, by the book, then I have all of these components across here that I need to comply with if they're inside my thermal envelope. If I'm in climate zone 2, I need to have a 0.40 window. I need to have R-13 in my walls, and so on." And so you could just comply with this prescriptively. In climate zone 5, where I'm at in Colorado, I have to have an R-20 in my 2x6 wall. So this is just a by the book approach.

There's also an option to use a different table prescriptively. And we'll look at that.

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But one thing that you have to keep in mind whenever you're doing the prescriptive compliance path: it's just telling the code officials that's the path you chose. You're gonna somehow, on your plans or in your documentation, you're gonna let them know

that you met all those requirements of that table for the U-factors and your R-values. And then you're also gonna have to be able to detail all of your mandatory items on the code, turn in your load calculations, make sure you have your equipment sizing done, make sure that your lighting meets the prescriptive requirements of 404. Did you seal all your ducts and are you gonna have to test because you have ducts in unconditioned space? Those kind of things all are mandatory requirements that still have to be met. So if you choose that prescriptive path, you just make sure that you still detail out all of this information on the plan.

But what if I don't wanna do R-20 in my wall?

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I wanna do R-19. Can I still do that without having to jump to one of those other paths, a UA alternative, or a performance path? Can I still do that? The code gives you this U-factor alternative. But that exact same table is the prescriptive table – R-value table. Same components across the top, same climate zones. It's just looking at all of these components as an assembly. So what is the U-factor for the entire assembly?

The other table we just looked at the R-value that we put on that wall. It would require me, in climate zone 5, an R-20. This table lets me look at the entire assembly, and maybe I can get away with that R-19 if I can calculate my assembly out to meet that 0.060 U-factor. So it's looks at – what is the U-factor for all of the materials, the entire assembly of the wall? And maybe I can get away with it that way. Maybe I'm doing better framing. Maybe I'm doing a great system on the outside.

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I look at every layer of the assembly and add it up, and that's how I meet the U-factor. You can see that an example would be if I did a U-factor – if I converted a R-20 that's required in climate zone 5, I would only get an R-16.67. So how is that equal? Well, because you're not just looking at the insulation. You're looking at the framing and the whole assembly. And as long as I get all of that U-factor added up to be the 0.060, I could do that. So some people do that. Very few – if I were just gonna do one component that I didn't wanna have to comply with that envelope, I could do this. Very few do this, because this is the same kind of thing that's behind the scenes in the UA – the total UA alternative path with

the REScheck and everything. And so very few people take the time to calculate this out.

You could go with this total UA alternative.

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This is a great path. It's starting to allow some trade-offs in the thermal envelope. Anything that can be converted to a U-factor can be traded off within that envelope. So this is looking at the whole sum of all the U-factors of the assemblies for the entire building. Instead of just components, it's looking at the whole building. So it calculates – you get this budget for the whole building based on your square footage. And then you just need to stay under that. So this is a great path. It's kind of looking at: "What can I do to worry my U-factor of the building and maybe still away with something? Or maybe I don't wanna put in this in R-20. I wanna put in R-19. Or maybe I don't wanna put in 0.32 windows; I wanna put in 0.34 windows. How can I do that and still comply with the code?" And so it gives you credit for better design.

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Maybe if I put in less wood, I can get in more insulation in the building. And so if wood has maybe an R-value of 1 per inch, where I can get a lot more R-value out of insulation. So maybe I can take some of that, if I do a 2x6 framing and 24 inches on center instead of 16 inches on center, less wood, more insulation. I could get credit for that. Maybe if I put in better corners and I can get insulation all the way back in the corners instead of doing these old type of corners that we used to do where it's nothing but wood, I'm gonna get a better U-factor this way.

It takes into consider thermal bridging. Anything we can do to reduce thermal bridging. Instead of doing 16 inches on center, go 24 inches on center. Look how much insulation you would get in there and how much less wood.

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Taking these kind of ideas to still get code compliance and maybe do something different. This is a great website, by the way: this Building America Solution Center. It's got great resources there. So be sure to check that out.

Maybe I'll do continuous insulation on the entire outside of my building, and I'm not required to. Look at how much credit I could get for that continuous insulation, and maybe offset the kind of windows that I have to put in. Or maybe I don't wanna do slab edge insulation. Hopefully you put it in, but you might wanna trade out of that because it's not convenient to do. So you take the credit for the things that you're doing, and offset the things that you're not wanting to do.

This is a 0.35 window. I wanna put in a 0.35 window. That's less than what the code would allow.

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So you can make it up because you put all of that exterior continuous insulation on the building maybe. It just converts everything to a U-factor. And as long as you stay under budget, you're good. It takes this twin house concept into consideration. So I have the house – it's modeling these two houses. I have this house: same square footage, same cardinal directions. Here's this house. If I built it to the 2015 IECC, here's my budget U-factor that I would have. But how do I really wanna build it? What windows do I really wanna put in? What insulation do I really wanna put in? Let's take that. And you calculate that U-factor of the entire building. And as long as you're staying less than or equal to the prescriptive house, you're good. You have a budget and you just stay under budget.

It's fun to calculate all of that. How do we do that?

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REScheck is a great tool. Free download from [energycodes.gov](http://energycodes.gov) that handles it for us. Doesn't mean you have to use REScheck. You could calculate it all out and turn in those calculations. But why do that when REScheck is such a great tool? So if you look at REScheck, you download the most recent version from [energycodes.gov](http://energycodes.gov), and it's so simple. You go through and you tell it: "Here's my project, where I'm building it, how many square feet, what kind of a building it is." And a lot of drop-down menus. So easy to use.

You tell it everything about your building and then you just go in and you pick: "Okay, here's the kind of truss I'm doing. Here's the kind of wall that I'm doing. Here's the doors and the windows and the" – and you tell it everything about your envelope that you're

doing: all drop-down menus on here. So easy to use. Great help menus. And what it does is start building you a budget, saying, “Okay, if you built this to the prescriptive requirements, here’s the budget that you would get in U-factor.”

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And then you would go in and tell it what you’re doing, and say, “Okay, well, based in what you’re telling me you’re gonna do, here’s the U-factor that you came up with. You are better. You pass. Because you’re 4.5 percent better than code in this instance.” So it’s a great tool; lets you know if you’re over budget or under budget. It prints out a compliance certificate that’s mandatory in the code. It prints out handy inspection checklists. And so that’s a great – the reports are wonderful to use.

If you’re a code official and you’re looking at this report, it’s always important to verify that they used the edition of the code; they used the right climate zone in their compliance. Did they get that green line? It’ll be green if they passed; it’ll be red if they failed. It also gives you, on that line, the maximum UA, and what they came in at under budget. So those are helpful things to look at.

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Always know if somebody doesn’t think I’ll look at it because they’ll turn a REScheck in with a red line. It’ll let you know if you failed, and how much. I ran one on my house [laughs]. I got 250 percent worse than code.

Okay. So other things to look at when you’re on the REScheck – it’s great. You can go in here and compare these wall assemblies to see: is this what the plan showed? Did they say that they’re doing this ten-foot high wall? Or did they say that this is the window that they’re gonna use? Is this how many doors are in the envelope? You just compare this to the plan. I also compare that to the Manual J load calculations to make sure that the guy designing the piece of equipment has also designed it to weigh – to what the REScheck is saying. They’re either using the same assemblies or they’re using the same R-values and U-factors.

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Verify that you have the right square footage and that you have – what kind of insulation, and that you’re putting in their cavity,

continuous – verify that according to the manual J and the plan. What the U-factor is for the windows: is that what they're really putting in? And it calculates a budget for you, so you'll see. I make them sign it so that I can just – it lets me know that they put some thought into it. Somebody had to sign it and sign off on it.

So it's a great tool. Prints out that little certificate that the code says is mandatory. So that's nice. Used to be required on the electrical panel. It's now allowed in a unobtrusive spot somewhere in the house. And so that's nice: that it prints that out. It also prints out this great checklist: based on what you put into the house, here's the items that you need to look at in inspections for this house. So that's a great tool for planners yours, and for especially inspectors.

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But REScheck only deals with the building envelope. Because its UA path only talks about the building envelope. It doesn't deal with mechanical or lighting.

Again: free download, [energycodes.gov](http://energycodes.gov). You just go to the website and there's a link to download REScheck or COMcheck. It's a great tool. This website, [energycodes.gov](http://energycodes.gov): very great website. Lot of information in there. So be sure to utilize that website.

All right. So that's prescriptive UA, looking at the envelope. Just looking at the envelopes. Now, let's take a look real quick at how houses have changed. So you have this 1910 house, versus this 2015 house. How have the houses change over the last 100 years? Why is this 100 year old house still standing? Well, it's standing because leaky, right?

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It was so leaky, the walls were able to dry to the inside or the outside. They were able to dry, and that's great. But what's happened is the fact that *we've* changed over the last 100 years, so our expectations have changed. So what is it that – why is this house not okay anymore? It's still standing. Why is it not okay for us? Because *we've* changed. Our expectations have changed. Back then, in this house, you knew you sat around – you know, you had maybe a wood-burning stove or something. And you were used to sitting around in a sweatshirt because my grandpa knew that he wore a sweatshirt all the time in his house. He was gonna be chilly sometimes. There's a lotta air moving through there.

Well, we have decided that we want to sit in our shorts all year round, and we don't want to pay a huge energy bill because all of the air is moving in and out of our building. Since we've changed, therefore our houses have had to change. So what did we do to those houses to make those changes? We added better windows.

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We added some more insulation. We've built things tighter so all the air wasn't leaking out that we were heating and cooling. But then our houses still were having some troubles staying comfortable and being durable and efficient. So what happened? We had to start taking a look at things as a – as a house as a system: how do all these things – “Maybe I need to think about: I put in this bad window. How does that affect my mechanical equipment? Oh, I had to put in a bigger piece [of equipment] to make up for all the heat that I'm losing. Or maybe I put in the really horrible lighting and so now these lights are putting off a lotta heat. But now I gotta make that up with my cooling system.”

So we just started thinking, “Well, maybe we don't need to look at each component: ‘Does this have good insulation? Does this have good R-value? U-factor?’ We need to look at the whole building: how does the whole building look together?”

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So that kinda systems thinking brought us to the performance path. So we have this performance path that looks at things – or how the whole house is gonna perform after we put everything into it. It allows the trade-offs that we used in the UA path, where you could trade insulation for window; you could trade R- and U-factors. But it also brings in: “Maybe I'm gonna trade off a little bit of my air infiltration. Maybe I'm gonna build a tighter house than I was supposed to. How will that help me, or maybe offset my windows or my insulation? How will a tighter duct or better lighting – how will all of this play into effect?”

So that's how the performance path comes into play: it takes that same twin house concept that we used in the UA path, but it compares the house built to the prescriptive path versus the house that you want to build.

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How do they compare? How does this one perform in relation to this one? And it's based on cost. So it's annual energy cost. How much would the house built to the prescriptive path be versus what I really wanna do? Which one – as long as what I'm wanting to build will cost less in annual energy costs than the one built to the prescriptive requirement, then I'm okay. Equal to or less. And so it's based on: how much will the annual energy cost be?

The code has some strict requirements on documentation and compliance. It gives you some strict requirements on what the software tools have to do. Some common software tools out there are REM/Design, EnergyGuage – common software tools for this path. It also gives you very specifics on what the compliance reports have to tell you.

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I have to tell you: which code edition What is the address – what went into that standard reference design? What went into what I proposed to do? So it gives you very specific requirements on what the reports have to say. It's handy because these reports will tell me: "Okay, here are my heating and cooling and water heating appliances. Here's how much they would cost if I used these according to the 2015 requirements. But here's what I'm proposing to do. So here's my annual energy costs: \$945.00 for annual energy costs. I was lower than the \$1,008.00 than it would've been if I'd've built it to code, so I'm okay."

And so it gives you the actual cost. It does it for your lights; it does it for other things. It also tells you: "Here's all the mandatory requirements of the code that I've met or exceeded." And I'm good. I've met my 2015 energy code.

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And I actually exceeded it by 6.3 percent. So it's nice that the reports show that. Very important that your report, no matter what you get, it shows you that they are compliant, using the code that you're on. Many times I get a performance report on a project and they say, "Well, it complied with the 2012 code." But this jurisdiction is on the 2015. Make sure it complies with that code. You're verifying compliance with the code, and not based on a HERS index score or some kind of energy rating index score. A lotta times, the reports will print out a score. But that has nothing to do with code compliance. It's based on: does it meet the

mandatory requirements and all of the requirements for the code edition that you're on? So be sure to check that.

You get a certificate at the end that says you've complied, and it tells you everything that went into the house.

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And all of your duct leakage results, your air leakage results for the envelope. All of those are on there, which is great. It lets you know if you've met or exceeded the code. Always makes sure somebody signs it. It also gives you other information, like: what were those blower door results? What kind of duct leakage did you have? And what kind of ventilation requirement did you have? Did you use an exhaust-only strategy, a supply-only strategy, or some kind of combination system? So this is handy that this report specifies that.

And then it also usually will print out – when you're using these kinda software packages that I showed you – these also print out those mandatory certificates that tell you that you met or exceeded the code, what values went in there, what your heating and cooling efficiencies were.

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These are all mandatory in the code that you provide this certificate, so it's nice that this program does that.

So that's a simulated performance path. Now, new to the 2015 for residential, you have this ERI path. It's Energy Rating Index path. And so it takes that score, and now you verify compliance based on the score. So pretty common: if you've dealt with EnergyStar or even some of the old reports on the simulated performance path, you'd get a HERS score or you'd get a energy score. And so it takes the home and says, "Okay. If I'm a standard home, I'd be at about a score of 100, a code house. And a zero would be net energy. I need to be somewhere in between there." And it varies depending on which code edition you're on.

But this one – because of the way that we hear these items when we're writing this code, it was written kind of towards the end of the code hearing.

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And so there were some sections in there that didn't line up after we got all done. So really wanna point out that every code could have some errata to it. You know, they print the code and then we start using it and we find: "Oh, maybe this should've been a comma instead of a period." Or, "Maybe this should've been a less-than sign instead of a greater-than sign." Or, in the case of this ERI path, it looked like the mandatory requirements of the code were no longer required. But that was just because of the way it all happened at the code hearing. But truly: the mandatory items are required. So be sure to go down and go to ICCsafe.org and download your errata for your code to find, at a minimum, the mandatory items do still have to apply when you use this ERI path.

So, what are the mandatory items?

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If you're using this ERI path, you have to meet the air changes. You still have to do your blower door testing. You still have to come in at 5 ACH to be in climate zones 1 and 2, and 3 ACA for 3 through 8. You still have to meet those requirements. Something a little bit different for this path is that it's mandatory that your building envelope – it's got trade-offs built in, but you cannot trade worse than the 2009 IECC for your envelope. So what does that look like? Well, here I have overlaid the 2015 and 2009 IECC tables. So you can see: in climate zones 1, 2, 3, and even 4, there're some trade-offs still there. The 2009 said you could have a 0.30 window; the 2015 says 0.25. So you still have a little bit of trade built in there. You have some trade in your walls and some of these climate zones.

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As you start getting into the more heating-dominated climate, you're running out of some of the trades. So there's very little trade-off. The worst you can do in your thermal envelope using this path is this 2009 prescriptive requirement.

The reference design in that twin house concept – the reference house is based on the 2006 energy conservation code. So what that's saying is the software is comparing everything that you do to that 2006 code. So the 2009 DOE made the determination was between 15 and 17 percent above the 2006, and we got maybe another 15 percent from the 9 to the 12. And so we're looking at what – everything's based off of that '06. How much more efficiency did we get to that '06 in the software?

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It's looking at a rating so now – we have this HERS rating that comes into effect. This energy score has to be – the score is what gives us compliance. Not necessarily which code we went off. So a lot of the same idea behind the performance path. It's just that can't do worse than the 2009, and you have to use a score for compliance. And so where do you fall on that score with the standard home being the 2006 code? So you have the ERI. You have the twin house, one being the 2006; then the house that I wanna build. Just tell it how you wanna build it, but you can't do worse than the 2009 envelope, and you have to do the mandatory requirements. So the score of the desired house needs to come in – per the prescribed – for the table of the code.

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So what does that table look like? If you're in climate zone 1, or 2, you would need to come in with a score of 52. And it varies by climate zone. So, here in Colorado, I'd need a score of 55 in order to pass this. 55 meaning: okay, on a score of 100, if I got a score of 55, I am 45 percent better than the 2006. So a score of 55 here – people say, “Well, how come I have to have such a low score?” Because there's more trade-offs built into this path. If you look at it, equipment trade-offs got built back in. So you could lower your score by putting in a higher-efficiency piece of equipment. You could lower your score by putting in some renewables. Or some PV.

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You could lower your score by – maybe if you're required to have three air changes per hour, but you make your house at one air change per hour. You could lower your score by taking credit for that extra ACH. Or you were required to have four CSM duct leakage, but you came it at two. All of these things can lower your score. And so that's why you have that kind of low score that you have to reach.

So those are the main paths through the residential code. Lots of different ways to get what you need to get. Lot of different paths and lot of different things. It's getting easier and easier to build the house you wanna build. Maybe not as easy to go prescriptive. Maybe if you chose at least a UA alternative with REScheck or

you pull in at one of these performance paths, it's a lot easier to start building the house that you wanna build.

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Let's look at some commercial buildings. So commercial buildings come in with a few paths as well. You have – the code would allow you to just use ASHRAE 90.1 in lieu of the IECC. You can use ASHRAE 90.1 and be deemed to comply with the IECC. You have to use ASHRAE 90.1 for the entire building, meaning the envelope, the mechanical, the water heating, and the lighting. You can't mix and match. If you go to ASHRAE 90.1, that's one compliance now. Or you could choose a prescriptive path. So the prescriptive path is there. And people always say, "Well, okay, you have prescriptive or performance. Where does COMcheck and all of that fit in?" We're gonna talk about that today. So don't worry about it.

So you have this prescriptive path. One thing to keep in mind is: we needed to get – commercial buildings kind of were lagging for a little while: lagging behind the residential buildings when it came to efficiency.

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We had so much focus on residential, we kind of forgot commercial for a little while. We needed to get some efficiency from the 2009 to the 2012. We said, "We gotta get better efficiency out of this building." And so it could've been done a couple ways. One: we could've just really cranked down all the numbers for your envelope, all the requirements. We could've just cranked that down by, say, 15 percent. But instead of doing that, in keeping with the intent of providing flexibility and encouraging innovation and technology, we said, "Okay, we'll crank down a little bit of the way. And then we're gonna give you a choice in how to get to the rest of the way. You choose. It's mandatory. If you go prescriptive, it's mandatory that you choose one of these options. But you get to choose how you wanna get the rest of the way there."

So prescriptive has: comply with all of the envelope, mechanical, water, heating, and lighting requirements plus choose one of these additional efficiency package options.

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You can go performance, which, again, is based on cost: what's the annual energy cost of the building? It's the way you propose it, compared to as if you built it do code – the prescriptive requirements of code. In the 2015, it says you have to come in at at least 15 percent better than your standard reference design. People always say, "Wait a minute. I thought this was minimum code. Why do I have to be 15 percent above?"

It's not that you have to be 15 percent above code. It means you have to be 15 percent above this standard reference design. Because this standard reference design doesn't have these additional efficiency option packages built into it. So we have to get – in order for the prescriptive and the performance to be equal, we need to be 15 percent above the standard reference design. Because we have to replace the fact that we don't have these additional options that are mandatory.

[0:38:03]

All right. So let's walk through the prescriptive code real quick and talk about these efficiency options. So I've gone through. I've met all of my mechanical, envelope, water heating, and lighting requirements outta the base code. And then I get to C406, and I have to pick one of these. It's mandatory. I have to either go in and put in ten percent more efficient mechanical, or I can do ten percent or more efficient lighting. So instead of one more per square foot, I do 0.9 more per square foot. Or I do enhanced lighting controls. Maybe some digital – some kind of enhanced control systems that will lower my lighting use by ten percent. Maybe I can use on-site renewables. You do renewables, it has to be on-site. It can't be like this solar farm somewhere. We're talking about on-site.

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Or a dedicated outdoor air system where the outdoor air is coming in and is being treated separately than the heating and cooling equipment: I have this dedicated system that runs quite efficiently. Or if I'm an occupancy that uses a lot of water – maybe a hotel, a hospital, those kind of occupancies – I could choose a more efficient hot water system; maybe some solar thermal or something.

So there's different options. 2012 had three options. 2015: six. So we want to provide flexibility, provide options. And, instead of us mandating how you get somewhere, we give you the option: how

do you want to get there? If you were already gonna put in a really efficient piece of equipment, then there: you've already met the requirements. Choose that one. So a lot of people are doing better-enhanced lighting controls nowadays or better lighting with LEDs and everything else.

[0:40:03]

So just choose those options if you were already gonna do that. So that's mandatory. That's how you do the prescriptive requirements. You have this prescriptive table just like we did in the residential where you have this R-value table. Breaks it up. Here's all your components. Here's your climate zones. And you just have to do what's on here prescriptively.

If you want – I hardly ever see anybody use this table, especially for metal building, 'cause they don't wanna do a double layer insulation system. Or maybe somebody doesn't wanna do slab edge insulation. How do you do that? You use a different path if you wanna get out of those requirements. Prescriptively, I do what it says in this table. I have the R-value table. I also have that same U-factor table. I can look at my component as an assembly – the entire assembly – instead of just the insulation I put on top of that component.

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In both residential and commercial, I would say: don't forget that every component on this table has a code section that goes with it. So you can't get all of the information you want just out of the table. You do have to go to some of the code sections to find out that: oh, this slab on grade insulation means top of the slab down, and it doesn't mean insulate under the whole slab. There're just different requirements that you need to make sure you're reading the whole – the code section.

So you still have those same alternatives just like you did. Then you say, "Well, where does COMcheck fit into all of this?" There are some alternate U-factor – F-factor, C-factor paths that you can choose. So the code does give you this COMcheck path. One thing that I will point out when you're using COMcheck: it does allow trade-offs.

[0:41:58]

And a lot of times people think, “Well, I can trade off my lighting for my envelope.” COMcheck is allowing you to trade off within your building envelope: I can trade my windows and my doors and my insulation and all those things that are in the envelope – I can trade those off. It prints out compliance reports for mechanical as well as lighting. But it’s not trading it all off. It’s allowing the trade-offs in the envelope. I love COMcheck. You can do this U-factor table and calculate the entire U-factor for your entire building if you wanna do that. You have to show how you came up with those U-factors; how did you come up with the U-factor for each layer of your assembly, as well as for the entire building? You could do that. But why? When you could go to DOE’s website at [energycodes.gov](http://energycodes.gov) and download the software for free, and use it?

[0:43:01]

It’s a great software. I don’t know a jurisdiction that doesn’t allow it from even the required. And so it’s drop-down menus. Make sure you’re on the latest edition, you’ve chosen the right code. Tell it everything about your project. And right here – remember I said: you have to, if you go with these paths – if you’re not using performance, you have to choose one of those efficiency options in C406. This one – you can go into COMcheck and it’ll tell you – you can go in there and choose which one so that it’ll tell you what your requirements are as you get into those different components. So it’s really great. It’s a great tool with a lot of drop-down menus. It’s easy to use. So you go in and you’re in the envelope and you just pick which component you’re looking at. And it has a bunch of drop-downs. Here I have a solid concrete wall.

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Okay, well look at all of the different options. And it’s gonna give me different U-factor based on: is it partially grouted or fully grouted or empty? And so it’s calculating the U-factor behind the scenes with U-factors from the ASHRAE default table. There’s all kinds of easy-to-use drop-down menus. I can tell it: “Here’s the type of building that I’m using. Here’s my interior lighting method. I chose the building area method,” Or “I’m gonna use the space-by-space method.” And then it gives you all the drop-downs that you need. I mean, you’re just going in there and telling it everything about your building, and it’s doing all the calculations for you behind the scenes. So easy to use.

On exterior lighting – you can evaluate exterior lighting in it. What I love about it is this Help menu. So you have this Help menu. I'm in here in my envelope and I have this question about: I see that I have to tell it what my projection factor is. I have no idea what that is.

[0:45:00]

So you go to the windows; you click on it. And look: it tells you, "Here's how you calculate projection factors." And it'll give you little boxes to fill in the blanks. And it's so great. Great help menu.

If you're going in, you're entering your basement walls, it doesn't really let you fail. So it said, "Okay, how high of a wall do you have and how much insulation?" And you fill in the blank and it carries those numbers over and does the calculations for you. If I'm slab on grade, which is one thing that comes in on the plans wrong every time, this one won't. COMcheck won't let you do it wrong practically. It's saying, "Here's the slab edge that needs to be insulated. How are you gonna do it? On the inside or on the outside? And how deep are you gonna go with your insulation? What value are you doing?" And it gives you all of these handy pictures, fill-in-the-blanks type of thing.

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It reminds you – if you say, "Oh, I'm putting in 500 feet of slab insulation," it says, "Oh, wait a minute. Don't forget. This is perimeter only. We're not talking about the slab area." And so it gives you all of these great pop-up tools to use. So really handy. Does say, "Oh, I chose 'Other.'" Maybe I have some kind of wall assembly that doesn't meet anything out of their hundreds of drop-down menus. I have this special wall assembly. Don't mean you can't use it. You would just go in and hit "Other," and say, "Okay, now I have calculated the U-factor on my own, and I put it in." So it lets you know that if you do that, that's fine. But you have to turn in documentation of how you calculated that U-factor to the code official along with your COMcheck.

So it's great. The reports print out wonderful. I always make sure that it's to the right code, that it's in the right climate zone.

[0:46:57]

I love the fact that it tells you what percentage of glazing and sky lights you have so that you can say, "Oh well, if I stayed under my

30 percent – if I go above 30, I got whole nother set of requirements that click in for my daylight zone.”

Here’s – it’s a office, and here’s how many square feet I have. I can check that. Tells me which efficiency package I chose so that I make sure this one says, “Oh, it went with lighting.” Then I go over to my lighting COMcheck and see: did they choose lighting? I wanna make sure that they did, and that everybody chose the same thing.

There are instances maybe when you could have not everybody choosing the same thing. If you were gonna choose more than one option – so maybe you’re gonna put in efficient mechanical *and* efficient lighting. Then the mechanical guy could say he chose efficient mechanical, and the lighting could say he chose efficient lighting. What you don’t want to happen is for the lighting guy to say, “Oh, we chose mechanical. And we’re just gonna use regular lighting.”

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And the mechanical guy to say, “Oh, we chose more efficient lighting.” Then they’re not complying with anything. So they either all need to say the same thing, or the specific disciplines have to choose their specific option. It’s just nice that you can verify it on all three portions of the COMcheck.

And, again, it’s just like the REScheck: you go in and you make sure that they’re using the right window and wall assembly that the plans say. Make sure the square footages match or the area matches. The R-values and U-factors – the R-values match the details on the plan. Did the play say – sometimes the plans will say, “Oh, they put in two inches of continuous insulation on the wall.” And you go to the COMcheck and it says, “Oh, well, they put an R-10 on the wall.” Okay. Well, that probably could be. So just making sure that the details on the plans match the COMcheck.

[0:49:02]

And the U-factors: did they put in the windows that they said they were going to? Are they counting for all of the doors? Making sure – you look at the plan on the door and it shows ten exterior doors. Does the COMcheck show ten doors? And it’s really – it’s a nice printout of: “Here’s my code compliance.” And so it’s a great tool for that. It also has mechanical compliance. I compare the mechanical COMcheck to the regular COMcheck to just make sure

that they're complying and that they have – okay, if the mechanical sheets show that they put in 20 units and the COMcheck says they only put in 1, maybe they need to change their COMcheck. But making sure that they match: that the size of equipment matches, the efficiency of the equipment matches, and that the number of equipment matches; that their additional efficiency package matches.

[0:50:02]

This one says they're doing the light. So go to the lighting COMcheck and make sure they chose lighting.

I love the mechanical compliance certificate because it prints out the inspection checklist. So the inspectors know that: "Here's all the things you need to look at, based on the equipment they chose." You don't have to worry about going through the entire code for inspections. You can just look at – the chose this equipment, so here's the inspections that apply to this equipment. So that's a handy thing.

Interior lighting: it evaluates interior lighting and exterior lighting compliance. So you can see that, here, if I'm looking at an office, this office chose the interior lighting power as their efficiency option. And so COMcheck automatically defaulted to the lower wattage.

[0:51:01]

This office chose the high-efficiency lighting option, or the HVAC option. So their COMcheck defaulted to the higher value. As you can see: one defaults to the lower; one defaults to the higher, depending on which efficiency package option that they chose. So it's important to verify those efficiency package options and that they are using the right one.

Great tool. Tells you, "Okay, here's your occupancy. Here's how many watts you're allowed. Here's how many watts you're choosing to use. And you're using less than – you're staying under budget on your watts, so you're okay." One thing to keep in mind is: it is important to compare these fixtures that they say they're putting in to the lighting plan. I have seen sometimes where they come in and say, "Okay, well, it says you're using 12 of these fixtures, but when I go to your electric plans, it shows 25 of them. So what are you really doing?" or something.

[0:52:01]

So just important to compare to the plans.

Exterior lighting compliance is great. “Lets you see: do you have all of your tradeable surfaces, your non-tradeable surfaces? How many watts are you allowed for exterior lighting? Here’s your budget. Here’s what you’re actually installing. Did you stay under budget?” Yes, I pass. Okay. Excellent. So it’s a great compliance tool there. If you were using the prescriptive path and not using COMcheck as a tool, then these are the calculations you would need to also provide in lieu of COMcheck. So you would need to show: “Here’s my occupancies, my square footages. Here’s all of the wattage that I’m allowed. Here’s all the wattage that I’m using.” So you would need to provide the same thing. This is why a lot of people use COMcheck: ‘cause it does it for you.

Your other option in a code is to use the performance path.

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So you have a performance path just like you do in residential based on annual energy costs. You put – it’s a computer modeling software. Again, the code gives you strict requirements on what the software has to do, what your reports have to say. You have to meet the mandatory requirements of the code. And the building you’re proposing to build has to cost less in annual energy than the same building built to the prescriptive requirements. It’s a lot of the same concepts, just different software. So there’re some different software tools out there.

Not as many people using the performance path as probably could be or should be. You could probably do a lot better by making sure your whole building performs and using the software packages. But not a lot of people know how to use them, and so sometimes it does cost a little bit more to find somebody that will get you through that performance path on a commercial building.

[0:54:03]

And a lotta people default to COMcheck to do their commercial compliance. But you do have that option of doing the performance for your commercial building.

So DOE has some great resources out there. Please take advantage of ‘em. I can’t stress to you enough the amount of resources that

DOE has available to you. You have resource guides. You have websites that have – here’s a paper on: does this air barrier meet code compliance? And here’s how to install this to meet code compliance. Or here’s some information on thermal bridging. There’s so much out there. You download COMcheck and REScheck for free. I downloaded the other day the guide to HVAC controls for plan reviewers and inspectors. It’s a great guide of – oh my goodness. The mechanical control section in commercial is so intense.

[0:55:00]

Well, here’s a handy guide of how to get through it. I mean, there’s all kinds of tools there. So please take advantage of them. You can go to energycodes.gov. Or they also have their resource center and help desk.

So that’s it for me. So, at this point, I think we are going to do questions.

*Rosemarie Bartlett:* Thanks very much for such an informative webinar, Shaunna. Boy, you really cranked through all those slides. Thanks so much. We’ve had several questions come in. Let’s see. There actually was a question that came in regarding Florida and Florida’s use of COMcheck. So I’ll go ahead and take that one and note that: yes, Florida’s specific code is available in COMcheck now. With one of the last releases of COMcheck. So you are able to use COMcheck for Florida’s 2014 code.

*Shaunna Mozingo:* Right. So I did get the list of questions.

[0:55:59]

So I’ll try to go through them as time allows. I don’t even know what time it is. Okay.

So the first question is: “What about podium construction for three stories above?” So, the important thing to remember when you’re talking about the energy code is it’s dealing with the thermal envelope. It doesn’t really necessarily matter how you’re building the building. Where is the thermal envelope? What is the portion of the building that separates the conditioned space from the unconditioned space? That assembly has to comply. That component has to comply.

If you're going above three stories, that's where you'd use the commercial code to kick in. So it depends on occupancy. Again, so a residential building: anything under the IRC plus or R-2s, 3s and 4s, three stories or less. If you're more than three stories on any occupancy, but if you're more than three stories on your R-2s, 3s, and 4s, and everything else is considered commercial.

[0:57:01]

So if you have more than three stories, you're using the commercial chapters, the C chapters. And then your R-2s, 3s, and 4s less than three stories, you're using the R chapters.

“If you have three story mixed use building, can you use commercial for the entire building, or it's wrong?” That depends on your jurisdiction. So right now the code says if you have a mixed use building, you use the residential chapter for the residential section; you use the commercial chapter for the commercial section if you're three stories or less. Once you go over three stories, it's commercial for everything.

“Can I use the commercial chapter for everything?” That would be a code official requirement. The code doesn't allow it, but that would be up to the code – I have seen some code officials will say, “Okay, well, I'm not gonna require you to do Manual J for the mechanical, the residential units.

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“And then I'm gonna require you to do – engineer some other engineered load calcs for the other mechanical – the other units. So I'll let you do just some engineered load calc for the whole thing.”

What you wanna be careful with is envelope requirements. Most of the time, people wanna use the commercial chapter for the entire building to get out of the required blower door testing. Let's just put it out there. And so that's what you – the code official has to make that determination. I do have one code official that lets you – if you're mixed occupancy or even an R-2 three stories or less – let you come in as commercial, but you have to do the entire building as commercial. Meaning you have to take that additional efficiency package. You have to do the commissioning and all of the other things that are required. You can't pick and choose the components you wanna comply with. But, to the letter of the code, you are not complying if you're using only the commercial code for that mixed use three stories or less.

[0:59:02]

If it contains R occupancies.

“Does the assembly U-factor include convective film coefficients?” Rose, you wanna cover that? Or Pam?

*Rosemarie Bartlett:* Sorry. Read that one again please?

*Shaunna Mozingo:* It says, “Does the assembly U-factor include convective film coefficients?” I don’t think so.

*Rosemarie Bartlett:* I don’t know, off the top of my head.

*Shaunna Mozingo:* I don’t think so. Because doesn’t the code say that if you use those film, that you don’t have to comply? I don’t know. But I guess – I don’t know. I don’t know the answer to that question. But we can find out the answer.

“Where can we get some reliable sources to find the R-value for the assemblies?”

[1:00:00]

Great question. So, you could, if you have access to – ICC sells a – IECC/ASHRAE 90.1 combined book. Or you can just get – if you just have ASHRAE 90.1, back in the appendix, there are some different things that show you: what is the U-value of everything? What is the R-value of different things? I think what you really wanna know is: how do you find the U-value of the assemblies? Because R is just based on the insulation. To find the R-value, you would go to the manufacturer and see what R-value is for their material. U-factor is for the whole assembly.

So if you wanna find: what is the U-factor, and how do we break that down, you can get ASHRAE handbook of fundamentals, or you could use the appendix in ASHRAE 90.1. They give you the U-factor for all of these different materials, all of the different construction materials out there, so that you could calculate the total for your assembly.

[1:01:03]

“Where are the requirements for doors and windows when using the R-value and U-value prescriptive method?” Well, it depends on

if you're doing commercial or residential for that one. So if you're doing prescriptive, the R-value and U-factors are in the table. For residential, it's all in the same table. It'll give you the windows and the doors and the walls. If you're in commercial, it depends on if you're opaque or not. So a opaque would mean it has 50 percent or less glass. So if I have a door that has less than 50 percent glass, it's an opaque door. Is it swinging or not swinging? If it's a swinging door, you're gonna find it in the U-factor table. If it's a non-swinging door, you're gonna find it in the R-factor table, or the R-value table.

[1:02:01]

Because those roll-up doors: they come with an R-value anyway. So you find the R-4.75 or whatever you're requirement is – if it's an opaque door, because it's less than 50 percent glass, and it's a non-swinging, it's an R-value for commercial. If it's an opaque door and it swings, it's in the U-factor table. If it has more than 50 percent glass, it's in the fenestration table or you count it with the rest of your fenestration. That's for commercial. In residential it's all in the same table.

“When spray foam is” – this is probably a good question for Rosemarie or Pam. “When spray foam is used in the attic, underside of decking, how do we use the REScheck?” I imagine it depends on a few things.

[1:03:01]

But, Rose, do you want to cover that? “When spray “When spray foam is used in the attic, underside of decking, how do we use the REScheck?”

*Pam Cole:*

You would have to choose “Other” as your assembly type, and provide the overall calculated U-factor for the assembly. There's not an assembly choice that's used for insulation underneath the roof deck. So that would be assuming that you have a conditioned attic and there's not an assembly. The assemblies that're in the REScheck pretty much follow the prescriptive assemblies that're in the code. So we are looking at implementing – or looking at how we can implement that type of assembly in the REScheck right now. But we're still researching that. So, in the meantime, you'd have to choose “Other.”

*Shaunna Mozingo:* Perfect. Thank you. All right.

[1:03:58]

“Are the checklists only for inspectors? I often sign the report and have to put ‘To be determined’ on items to be installed on a later date.” So, the checklists aren’t just for inspectors. So when you submit your – assuming you’re talking about the COMcheck and REScheck inspection checklists that get printed once you print your reports. It also prints these inspection checklists. Hopefully you’re clicking on that option so that prints it. It’s a valuable tool. You turn those into the building department with your plans.

The inspectors can use them for inspection. But I was just teaching yesterday a class of architects that – they print it out and use it to make – they also use it to make sure that, before they do their final submittal of their plans, they have that checklist and make sure that everything that they called out on the plan is matching their COMcheck. So they use it kind of as a tool to make sure they included everything on the plan.

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The plan reviewer also can use it as a checklist. So it can be used by more than just the inspector. But it is supposed to be signed. And you *should* be checking everything that you’re supposed to have to comply with. So I’m not quite sure on this putting “To be determined” on whether or not they have to install it. I’m not sure whether that’s coming into play.

“What software is being used to generate a report right now?” Oh, for a performance report? It depends on which performance software you use: if it’s residential or commercial. So it says that this question came in while I was showing the performance report. I’m guessing it was a performance report for residential. And that was using REM/Rate.

[1:06:00]

So that was using REM. Those reports that I showed that were from EnergyLogic – those were all REM reports. That I showed.

Okay. “When prescriptive method is used, and a builder insulates more than the minimum required – for example, it requires R-19 walls, but he puts in R-30 – can we still use prescriptive, or change to other methods?” No. The code is set up so that you can always do better than code. You can always go better than code. You just can’t do worse. So that table – that prescriptive table is the worst

you can do and still get away with it *[laughs]*. Right? You just want to do – R-value is: the higher the number, the better. U-factor is: the lower the number, the better. So if it's R-19 and you put in R-30, great. You don't have to jump to another path. If you want to get credit for that to trade out of something else, you need to use a different path.

[1:07:02]

But if you just wanna do better, you can do better all day long. I would say that, whether you're doing better or worse, it is very important that you let your mechanical guy know. So that he's designing a piece of equipment based on what you're actually doing, and not just what they think the code is. If you say, "I'm gonna go prescriptive," then that mechanical guy is using 0.32 for your windows and R-19 in your walls, or whatever the requirement is for your climate zone. But if you're doing better than that, he could be designing a piece of equipment that is not gonna work efficiently and will be too big. So make sure, no matter what you're doing, that you're communicating with the designer.

"What justification do you have for including solar? The code doesn't contain any reference to solar at all."

[1:07:59]

Residentially, that is true. Residentially, there's not really any mention of solar. All I mean is: when you're using the performance approach, the software will give you – in the ERI path, it will allow you to lower your score if you use some PV. That's in the software and I believe it might be in the tables of what can go into the standard reference design. When you're using commercial, solar *is* mentioned in renewables. You have to use – if you choose that additional efficiency package of the renewables, then it gives you a specific amount of how much that renewable needs to do to save energy.

[1:08:59]

So you're right: the only mention of solar in the residential is if you use that ERI path. And commercial: it's in there if you choose renewables as one of your options. Or if you use the performance path, it might have an effect on your performance.

"Where is the requirement for mandatory maximum ACH-50 values in the ERI path?" That is – I had that slide, but I don't

know. I don't have it in front of me. So let me look that up in the code. So if you are in the code and you chose the ERI path, which is in section 406 – remember: you have to download the errata. You have to download the errata to see that the mandatory requirements of the code are still in there. That's where it's at. Because the way that 2015 is currently written, it's referencing some code sections that used to say mandatory.

[1:10:04]

And now it doesn't. And so there's an errata fixing all of that. So please go to ICCsafe.org and download a errata. Then you will see: if you chose the ERI path, the mandatory requirements of 402, 403, and 404 are still in effect. You *have* to do the glowadore testing; you have to do the ACH-50, because that is a mandatory requirement. And so that's why it's confusing if you're just looking at R406 right now. Because it's referencing some different sections. So download the erratas. Then you'll get the right code section.

Let's see. "I'm hearing of areas in Minnesota, climate zone 6 and 7" – that's where my boss is today teaching. He says it's 12 degrees.

[1:11:00]

– “where continuous insulation is being required for table C402.1.3. Can you confirm that continuous insulation is not required when using the UA compliance path?” Okay. All I can tell you is what the code will allow. Jurisdictions are allowed to amend and do things to their code based on what they feel is right for their climate zones and for their communities. Right now, if you're using table C402.1.3 and you're using a certain kind of wall, you have to use continuous insulation. And if you use the UA component, or you use COMcheck, or you use performance, or you use one of those other paths, you *could*, by the letter of the code, trade out of those. And say, “Okay, well, I'm gonna make it up somewhere else in the building.” By the letter of the code, that is true.

[1:12:00]

But you have to check with the jurisdiction to see if they've overwritten that and amended it to – it could be very likely that Minnesota has said, “No, we're not gonna let you trade out of that.” I don't know that for sure, but that could very well happen.

“How do you justify including solar in the ERI?” *[Laughs]*. I’m not justifying anything. I’m telling you what is allowed right now. I can tell you that there are many – we’re writing the 2018 code right now. There are many proposals to either allow solar or not allow solar. We’ll see where that ends up. Right now, the software that’s used does allow you to put some solar in there and reduce your score. I’m not saying that’s good or not. I’m not justifying one way or another. I need to hear the arguments at the code hearings next month, or in April. So I don’t know what those arguments are. I am not justifying them.

[1:13:00]

“When does an existing building renovation need to install an additional efficiency package option?” Well, if you go to see – we’re talking about existing buildings or a commercial building. When does a commercial addition or remodel – no. When does a commercial building renovation – not a addition, but a renovation – need to comply with the efficiency package? So you’d go to chapter C5 – I don’t know how we’re doing on time, but I’ll just keep talking till they tell me I have to stop. We go to chapter C5 and we’re looking at renovations. It’s very specific to tell us which sections of the code we have to comply with. So if you’re in C5 – sorry, I’m just in my code here, and I’m on renovations, which is section C503: alterations.

[1:13:57]

It’ll tell me which sections of the code I have to – it says “Alterations complying with ASHRAE don’t have to comply with these codes. But the rest of it says, “You have to comply as if you were new construction.” “The building envelope has to comply with 402.1 through 402.5.” And it gives you your lighting. It doesn’t state anywhere in there, on an alteration, that you have to comply with C406. It says, “If you’re mechanical, you have to comply with 403. If you’re lighting, you gotta comply with 405. If you’re in the envelope, you comply with 402.” And it gives you times when you don’t have to and times when you do have to. But nowhere in there does it say you have to comply with C406.

So existing buildings – if you’re doing an alteration to an existing building, you do not have to go in there and pick one of those additional efficiency package options. It would be quite hard to do: to figure out which package option is gonna serve the entire building now that you’re remodeling it.

[1:15:01]

So it's not a requirement for existing alterations.

All right. You've already answered the Florida question. "How does COMcheck get accepted if it does a budget type analysis, which allows the non-compliant window U-factor, and there isn't a total UA alternative like the residential code?" There is a total UA alternative. It is section – well, I have to back up for a second. I get that it's a little bit hard – if you're not on the '15, it's a little bit harder to find it. But it is allowed because there is a C402.1.5 I wanna say, but I'm gonna look it up so I don't misquote. If you're looking in the commercial chapter under C402, 'cause we're in the building envelope, and if you look at – they have 402.1.3, which is your R-value method.

[1:16:03]

You have 402.1.4, which is your U-factor, C-factor, and S-factor method. And you have 402.1.5, which is your component performance alternative. You could get COMcheck out of this 402.1.4 and 402.1.5 saying, "Show me the alternate. What is a U-factor or my C-factor or my S-factor alternative?" That's where COMcheck fits into play. Is under those paths. So there is a requirement. It just – they don't call it UA alternative like they do in the residential. Because they're looking at more than just U. They're looking at U, C, and S. So it's the U, C, and S.

Now Pam and Rose can correct me if I totally blew that up  
[laughs].

Pam Cole: Well, just a little. So –

Shaunna Mozingo: Go ahead.

Pam Cole: – COMcheck uses ASHRAE appendix C methodology.

[1:16:59]

And it's based on energy performance factor. So it's looking at a budget building, proposed overall budget factor. So, really, it's not just UA. There's a lot more involved in the calculations. Best place to go is to the technical support document that's out there on the energycodes.gov website. But also to have ASHRAE 90.1, and go

to appendix C. And all the assemblies and the calculations that're used in the back and the COMcheck are part of that appendix.

*Shaunna Mozingo:* Great. Awesome. "How do you know when a renovation or alteration is required to comply with a code?" If you're in the – anything before the '15, you're gonna find it in chapter one. If you're an alteration, addition, or historic buildings – those are all in chapter one of what has to comply or not. Pretty much it just says: "You have to comply as if you were new construction unless you meet one of these exceptions."

[1:18:01]

The 2015 brought in that existing buildings chapter. So it says, if you go to C5 – if you're a commercial building, you'd go to chapter C5. If you're residential, you'd go to R5. And it will tell you: "If you're an addition, choose everything that has to comply. And if you're an alteration, here's everything that has to comply. If you're a repair, here's everything that has to comply. If you're an historic building, here's everything that has to comply." So it lays it out for you rather nicely in the 2015 code.

"What is turning out to be the least costly way to get a metal building roof to comply?" Well, you know, whenever you have metal in your building, then you have some thermal loss. And so, yeah, the code gets pretty restrictive, and says, "You need to put the double layer system, and you need to put in more insulation. You need to have some continuous insulation in there." So there're some different requirements for metal buildings. Not everybody likes to do 'em.

[1:18:58]

In fact, I think probably once, in all of my plan reviews, have I ever seen a metal building come in meeting the prescriptive requirements with the double layer system. Most people use COMcheck or the performance approach to get out of that, to find a different way to comply with their metal buildings. They make it up somewhere else in the building. We could sit here all day and talk about whether that's good or bad. But what it does is it allows you to make it up somewhere else in the building and not do the double layer system on commercial that is required.

So, to tell you the least-costly way – I don't know. Because there's probably so many different insulations out there. There's so many different ways we could look at it. Do I put in a better window? Do

I make up the insulation here or there? Or what kind of insulation do I use? There's so many different things that could go into that. I don't know. I just know: usually people trade out of it using one of the alternate paths.

[1:20:01]

Let's see. I think I have two more questions. "Insulated overhead door companies often don't report effective U-values or R-values. But just a nominal door panel R-value. How do you suggest converting this effective U-value for COMcheck?" Pam? So, R is 1/U. U is 1/R, but I don't know.

Pam Cole:

You could use the reciprocal of it. However, depending on the door, you are still – there's requirements that – there's ratings and tested through NFRC. So if this is a glass door, greater than 50 percent glass, then if it's not tested and certified through NFRC, then you're having to use the default tables that're in the code. And those default values are actually embedded in the COMcheck. However, they're worst-case scenarios. And most of them do not even meet the prescriptive values in the climate zone.

[1:21:01]

So the best option is to truly – when you're looking at fenestration and doors, is to look at what the requirements are as far as if there has to be a rated, certified, labeled product. And, if not, will those default values work for that building, or can you trade them off? 'Cause you would have to look at making up the difference for those worst-case scenario ratings, those default values.

Shaunna Mozingo:

Yeah. Usually if you have to use the default values, you don't have a very good chance of your COMcheck passing [laughs]. You really have to make it up somewhere else. And one thing I would caution about using default values too is: if you don't know the U-factor or the glazing coefficient and you have to use the default, keep in mind that that's always what the mechanical guys is gonna use for his calculations. So when you end up putting in – you say you're gonna use a default value, maybe the 0.55, but you end up putting in truly a 0.35, then the mechanical guy who's used 0.55 in all his calculations could have some oversized equipment.

[1:22:05]

So it does become really important to verify everything that we possibly can.

The last question that I have is a tricky one, right? So: “Must licensed engineers turn in calcs that will be reviewed by someone that is not an engineer?” You know, that’s how it is in the code everywhere. You know, you turn in structural calculations, mechanical load calculations. I’m not an engineer, but I review them all day long. Because I know what goes into them. I can’t create them, but I know what goes into them. At a minimum, I could say, “Did you use the right climate zone in your load calcs? Did you use the right U-factors and R-values and elevations and heating degree days and cooling – did you use all of the right stuff that went in there?” I don’t have to be an engineer to see what values you used.

[1:23:00]

And so that happens all day. Not all plan reviewers are engineers, but we still look at your calcs. Some jurisdictions say turn in a stamped whatever it is, and they just look to see that it has a stamp, and they leave it. And some – I get plans in all the time that have an engineer’s stamp on them, and I review them. Most engineers will say, “Oh, thanks for the second set of eyes.” You know? I’ll say, “Wow, this span is kinda big. The table says it can span this far. You’re showing this.” “Oh, yeah. Good catch.” You know? Others don’t want you looking at their stuff. So it just depends. That’s just the way the code is. There’s no way that a building department could stay in business if they had to hire nothing but engineers to look at everything. So I don’t know a great answer for that.

That’s all the questions that I have. I don’t know if you got more.

[1:23:59]

*Rosemarie Bartlett:* There were a few more that unfortunately we’re not gonna have time to get to, since we’re at the end of our time. But thanks, Shaunna. You did a great job presenting and getting through that long list of questions. So thank you very much.

And thanks to everyone for joining us today. We really appreciate it, and we hope that you’ll continue to join us as the energy code commentator series continues. Again, the second Thursday of every month, we’ll have a different topic. And the U.S. Department of Energy’s Building Energy Codes Program thanks you for your attendance today.

*[End of Audio]*