Energy Code Webinar Series - An Introduction to the 2021 IECC

Great Thank you. Welcome, everyone, again to our second webinar. Next slide, please. This is our second webinar in HUD'S energy code webinar series to outline HUD'S minimum energy standards. On November 19, we hosted a webinar on implementing HUD'S latest minimum energy standards, specifically for the HOME Investment Partnership Program, HOME American Rescue Plan (or HOME ARP), and Housing Trust Fund projects. Today's webinar is focused on the 2021 International Energy Conservation Code, IECC.

Next Monday, December 9, we will host a webinar on the ASHRAE 90.1-2019 standards. And then an additional webinar will address alternative options for compliance, and that webinar will be scheduled soon. Previous and future webinar recordings will be available on the Minimum Energy Standards webpage on the HUD Exchange, and you can register for the energy code webinar series at www.hudexchange.info/trainings. Next slide.

So I'd like to briefly introduce you to today's presenters. I'm Dana Bartolomei. I'm a senior manager in ICF's Housing and Community Development Group. And I'm joined today by Drew Poling, a Program Analyst in HUD'S Office of Environment and Energy, and by Mike Turns, who is a senior research analyst at Pacific Northwest National Laboratory.

In a minute, I will turn it over to Drew to provide the background on HUD and USDA's minimum energy standards. Then I'll provide a brief introduction to the 2021 IECC, and I will turn it over to Mike Turns, who will provide a more detailed overview of the 2021 IECC and highlight changes between the 2009 IECC, which was HUD's previous minimum energy standard for single-family and low-rise multifamily, and the 2021 IECC. So Drew, take it away.

Thank you. And thank you, everyone, for joining us today. We can go to the next slide. I'm just going to kick things off with a little bit of background on the final determination that was published by HUD and USDA last spring. So a little bit on the scope and purpose.

The Energy Independence and Security Act of 2007, or EISA, requires HUD and USDA to jointly adopt the most recently published energy efficiency standards, subject to a housing affordability and availability test. Before the final determination published last year, HUD and USDA currently required the 2009 IECC and ASHRAE 90.1-2007.

So after going through the affordability and availability testing and also an extensive public comment period where we took into account the feedback we received and updated the preliminary determination to the final determination, we published our final determination in the Federal Register on April 26, 2024. And this brought HUD and USDA back into compliance with EISA by adopting the 2021 IECC and ASHRAE 90.1-2019 as minimum energy standards.

So this notice only impacts new construction. I want to be very clear there. And also, the updated energy code does not apply to FHA-insured or USDA mortgage financing for existing housing or manufactured housing. You can go to the next slide. And here a little bit more on the current determination.

So the final determination or adoption of energy efficiency standards for new construction of HUD and USDA financed housing, again, was jointly published by the Departments in April 2024. It applies to new construction for HUD and USDA programs covered by the statute and establishes the 2021 IECC as the minimum standard for single-family and low-rise multifamily housing and ASHRAE 90.1 2019 as the minimum standard for mid- or high-rise multifamily housing buildings with four or more stories.

And so here, you can see the covered HUD and USDA programs. For HUD, covered programs include Public Housing Capital Fund, Capital Fund Financing Program, Choice Neighborhoods Implementation Grants, project-based voucher program, Section 202 Supportive Housing for the Elderly, Section 811 Supportive Housing for Persons with Disabilities, Rental Assistance Demonstration (or RAD), FHA single-family mortgage insurance programs and multifamily mortgage insurance programs, as well as Home Investment Partnerships Program, or HOME, and the Housing Trust Fund program.

And then for USDA, it's Section 502 Guaranteed Housing Loans and Rural Housing Direct Loans, and Section 523 Mutual Self-Help technical assistance grants for homeowner participants. And go to the next slide. So in adopting the 2021 IECC, HUD found significant estimated savings for this standard: 34.3% more efficient than the

2009 IECC or HUD'S previous requirement. And cost savings across all units are estimated at $73 million per year, or $1.48 billion over a 30-year period. So quite significant both on the efficiency and cost savings side of things. And on to the next slide.

And here, we have the compliance dates by program. So the first program is that this went into effect for were HOME and Housing Trust Fund with the event triggering compliance being participating jurisdictions or housing trust fund grantees funding commitments. It went into effect 180 days after the effective date or actually just last week, November 28, 2024.

And then 12 months after the effective date, or May 28, 2025, the new requirements go into effect for FHA insured multifamily. And the public housing Capital Fund and project-based vouchers programs for FHA insured multifamily, the triggering event is the pre-application submitted to HUD for public housing. It's the HUD approvals of development proposals for new Capital Fund, mixed-finance projects, and project-based vouchers.

And then finally, we have 18 months after the effective date or November 28, 2025, and this is when it goes into effect for FHA-insured single family, as well as USDA single family, direct guaranteed, and self-help loans. And the triggering event here is the building permit application.

Now, for the Rental Assistance Demonstration program, this is actually already been implemented and was required through a Federal Register notice for the program published on July 27, 2023. And then for competitive grants, so Choice Neighborhoods Section 202 and Section 811, it goes into effect when the next subsequent NOFO is published after the effective date, which was last April 2024. Or, excuse me, May 2024.

And then finally, we do have one extended compliance period for all programs with projects in persistent poverty rural areas, which those regions are defined based on USDA persistent poverty rural area maps. We've extended the compliance period out to 24 months after the effective date or May 28, 2026. And with that, I'll pass it back to Dana to provide a little bit more background on the 2021 IECC.

Great. Thanks, Drew. Next slide. So again, there are two codes that are specified in statute and adopted in the final determination. The 2021 IECC has been adopted as the minimum standard for single-family and low-rise multi-family housing, and ASHRAE 20

or 90.1 2019 has been adopted as the minimum standard for mid or high rise multifamily housing, which is 4 plus stories. So today's webinar is going to focus on the IECC. Join us next week for our webinar on ASHRAE 90.1, 2019. Next slide.

So big picture, how does the IECC improve a home? So the IECC is the International Energy Conservation Code, and it is used to set requirements for minimum levels of energy efficiency in buildings. The IECC is the most adopted model energy code in the United States, and it is developed through a national consensus-based process. And an updated version is published every three years.

So what types of things does the IECC address? There are sections in the code that address different aspects of buildings that impact the energy efficiency and performance of the building. So for example, there is a section of the code that addresses a building's thermal envelope, and this includes specifications about insulation and walls and ceilings and floors.

And additionally, it covers window performance and air leakage in and out of the building. So these are the items that are outlined in green on the graphic above. And improving a building's windows insulation and sealing cracks can help keep a home more comfortable and reduce the amount of heating and cooling needed, which can ultimately save you money.

The next major section is broadly defined as systems. So duct ceiling that carries air throughout the building, hot water systems and mechanical ventilation that bring fresh air into the building, this also includes your HVAC equipment, improving these systems can improve the indoor air quality of a home, and properly sizing HVAC equipment can help you reduce costs and prolong the life of your systems.

So the 2021 IECC also covers electrical power and lighting systems. And so this means that there are requirements for efficient lighting and controls, which can lower your electricity usage and cost. So I will note that household appliances like refrigerators or dishwashers are not within the scope of the IECC. And generally, those minimum levels of energy efficiency are set by DOE appliance standards. Next slide, please.

So anticipated benefits. Adoption of these codes and building to these codes can yield a lot of positive benefits. So the first is initial and ongoing cost savings. More energy-efficient homes reduce energy bills and costs. So building to the 2021 IECC is

estimated to save nearly 1,000 in annual energy savings for single family household and 400 in low rise multi-family housing units. There are also health benefits.

So improved energy efficiency often translates into better indoor air quality. Homes built to the 2021 IECC standard are less likely to have issues like mold and moisture, which can contribute to respiratory problems. There are also enhanced comfort benefits, so better insulation, efficient windows, and improved HVAC systems can help homeowners and renters maintain a more consistent indoor air temperature, which can lead to greater comfort.

There are also resilience benefits. Building to higher energy standards can enhance a home's durability against extreme weather events, and enable passive survivability, which refers to a home's ability to maintain critical life support conditions in the event of extended loss of power or water. Next slide.

So codes are adopted at the state level. So as I mentioned above, the IECC is the most adopted model energy code in the US. However, it is common for states to make amendments to the IECC to tailor the code to meet specific needs within their state. So in practice, the code in each state is often unique.

So the minimum energy standards page on HUD Exchange includes a map that is produced and updated by the US Department of Energy that shows what IECC code each state's adopted code is equivalent to from an energy efficiency standpoint. So for example, the states on this map that are in dark green-- Washington, California, Illinois, and Florida-- have already adopted codes within their state that are equivalent to the 2021 IECC.

So I encourage you all to visit the site to see which code efficiency category your state's energy code is equivalent to, and this will help you determine the incremental effort that will be required to build to the 2021 IECC standard for HUD and USDA assisted projects.

So the point that I really want to drive home here is that the HUD and USDA minimum energy standards require you to meet the unamended 2021 IECC or its equivalent. So what if your state has nominally adopted the 2021 IECC, but it included amendments that reduce the overall efficiency?

Well, for a HUD or USDA-assisted new construction project, you must build to the standards of the unamended 2021 IECC or its equivalent. So for those states, homes would have to be built to exceed the state code. And another example is, what if your state has not adopted a statewide code? So for a HUD or USDA-assisted new construction project, in that case, you still have to build to the standards of the unamended 2021 IECC or its equivalent. And if you have questions about that, do not hesitate to put those into the Q&A box, and we can address those during the Q&A session. Next slide, please.

The last thing I want to touch on is alternative compliance pathways. There are a variety of high performance building standards that you are all probably all familiar with that may be an alternative compliance pathway to meeting the minimum energy standards. So the industry is already building to standards that in many cases meet or exceed the 2021 IECC or ASHRAE 90.1 2019.

So often, low income housing tax credit qualified allocation plans require or incentivize a wide range of high performance building standards, including enterprise, green communities, LEED, or passive house. There are tax credits available for building to an eligible version of ENERGY STAR program requirements, and we know there are larger tax credits available for homes that are certified to DOE Zero Energy Ready Home program.

So HUD plans to publish a list of high performance building standards that will be accepted as alternative compliance paths for these standards. We will have a webinar on those pathways in the future, as I mentioned at the top. And the pathways may include ENERGY STAR Certified Homes, DOE Zero Energy Ready Home program, and other high-performance building standards that set or incentivize the 2021 IECC or ASHRAE 90.1 2019 as baseline standards.

The other thing I'll mention is that the recently published 2024 IECC may also be accepted, but that is contingent on a DOE analysis that shows increased efficiency over the 2021 IECC. So now I'm going to turn it over to Mike Turns from Pacific Northwest National Laboratory to dive deeper into the 2021 IECC and highlight changes between the 2009 and 2021 IECC. Mike.

OK. Thank you. I was going to turn my camera on here. But now that I've started presenting, I can't do that anymore. Oh, yes, I can. OK. All right. Good afternoon,

everybody. So this was pretty well-- very well teed up by Dana and Drew. But I'm going to give an overview of the changes between the 2021 or between the 2009 and the 2021 IECC, just the residential provisions. We'll cover that definition of residential as well, just to be clear.

Hi, Michael. We're looking at your--

Oh, shoot. Sorry. We practiced so many times. OK. So we'll be talking about a brief introduction, although a lot of this was already covered, so I'll probably do a short version. Energy codes. Well, DOE building energy codes program was not covered yet, but energy codes 101, climate zone changes, compliance paths. So it's a choose-your-own adventure in the energy code. We'll talk about the different options there.

And then we'll go through the heart of the IECC residential provisions, chapter 4. There are three main sections for depending on how you categorize it, but building thermal envelope, in other words, our insulation and air barrier, mechanical systems, lighting, and additional efficiency package options. So those are the broad categories that we'll go over.

So the Building Energy Codes program is a program of the Department of Energy. It's to support building energy code development, adoption, implementation, and enforcement processes to achieve the maximum practicable, cost-effective improvements in energy efficiency and decarbonization, while providing safe, healthy buildings for occupants.

And so PNNL supports DOE in this program. And the program is directed to participate in industry processes to develop model building energy codes, including the IECC. They also issued determinations. So PNNL does analysis, and this was mentioned previously by Dana, I think. And basically determining whether the latest model code is more efficient than the previous version.

Also directed to promulgate standards for federal buildings and provide technical assistance to states to implement their energy codes. And that's really how-- one of the main things that I do to support Department of Energy through my work at PNNL. So we are here as a resource to help states and jurisdictions mainly with adopting and implementing efficient energy codes.

And this one-- Dana already did a good job covering most of this stuff. I think the only thing that maybe wasn't mentioned is that the IECC is in a suite of other building codes. There's plumbing codes, mechanical codes, electrical fire, et cetera. Urban wildland, interface codes. There's all sorts of other codes, and this is one of those codes.

And they tend to work together. I guess every once in a while they might butt heads, but that's pretty rare. And they often do cross-reference each other, and we'll see one of those cases in this presentation. And then if you really want to get it straight from the horse's mouth, you can view the energy code at codes.iccsafe.org. So that's just available to view for free for anybody.

All right. Drew was saying that this was 30 some-- the 2021 is 31% better than the 2009. So that tees it up pretty well. But this is a graph just showing the energy use of homes built to the energy code over time. It's an index that was pinned to the 2006 version of the IECC, so that's a one and then every point below, that is a percent more efficient.

So just to give you a little historical perspective, we're going from the 2009 to the 2021. There was a decent jump between '06 and '09, maybe a 10% or so jump there. And then there was the biggest jump that has occurred throughout the history of the IECC is between the 2009 and the 2012 that was-- depends on climate zone, but up to a 25% or so jump in efficiency.

Period of relative stagnation here throughout the 2015 and 2018 IECC, and then 2021 takes another 5% to 10% jump. And 2024, we're not there yet, but some states are getting there pretty quickly. That one takes another five or so percent improvement in efficiency. But overall, like you said, we're looking at a 30% plus improvement in efficiency building to the ‘21 standard.

And Dana showed this map, but just to give another quick overview of it. These are color coded based on the equivalent efficiency of the code that's adopted in that state. So these dark green ones are on the 2021 IECC or equivalent already. So Vermont, Massachusetts, New Jersey, Florida, Illinois, Washington, California, and Hawaii.

So in those states, you really don't have to do anything different other than meet the statewide code. But if you're anywhere else, you are going to be-- to meet the HUD

standard, you're going to potentially need to do things different than you're doing just to meet the minimum code requirements for your state or jurisdiction.

So there are a lot of states in the Northeast that are on the 2018 IECC-- plus Nebraska, New Mexico, and Oregon, and Louisiana or equivalent. Couple of states on the 2015-- Texas, Utah, Maine. And then a big swath of states that are on the 2009 IECC or equivalent throughout the Southeast and up through the Midwest and a few Western states as well, and a couple of states that are below the 2009 IECC level.

So those are the states where you're going to have to do-- make improvements in efficiency above and beyond the statewide code. We also have some states that are in white here. These are home rule states, meaning that the local jurisdictions are responsible for adopting energy codes. And this doesn't really tell the full story as in some of these states, there are significant metro areas that are covered by efficient codes. There's just no statewide code there. And PNNL and DOE, we are actually working to change these states from a-- to a different color based on those local adoptions.

So that's where we stand in terms of adoption across the country. The code itself has been reformatted a little bit since the 2009 version. It was split into commercial and residential provisions. So it's basically like having two different codes under one umbrella or between the covers of one cover.

But in the 2009 chapters 1 through 3 and chapter 6 were shared by residential and commercial buildings, and then that was split out entirely. So there's chapters 1 through 6 RE, meaning residential energy, and then there are also chapters 1 through 6 CE for commercial energy. So just if you're leafing through the code or browsing through it online, make sure that you're in the right half of the code you're looking at residential or commercial.

Previously, it was chapter 4 was residential, and chapter 5 was commercial. But now we have-- I'll just run through the chapters here. Chapter 1 is administrative requirements. It has requirements on construction documents and required inspections, among other things. Chapter 2 is the definitions. Throughout the code, there are italicized words, and those are ones that will appear in the definitions chapter. So you can look those up to get more information.

Chapter 3 is general requirements. It's a little bit of a potpourri, but the main thing that is in there is the climate zones, and we'll go over those in just a minute. Chapter 4 is really the heart of the code, and that's what we're going to spend essentially all of the remaining time on.

Chapter 5 is a new chapter, existing buildings. There used to be a section that would cover that in chapter 4 and in chapter 5. But now there's its own entire chapter for existing buildings. Not really relevant to the requirements that we're talking about today, so we won't cover that. Reference standards. So anytime that another standard is referenced within the IECC, it is listed alphabetically with the full citation in chapter 6.

There are some new appendices. Again, that these don't really apply to the HUD requirements, so we're not going to go over those today. But there are some appendices that can be adopted by local jurisdictions. And an index for if you need to look something up by a keyword, say.

All right. So this definition has not changed. So we're only talking about residential buildings, or at least the IECC's definition of residential in this presentation today. So like I said, it hasn't changed since the 2009. They've maybe slightly tinkered with the wording over the years, but we're talking about 1 and 2 family dwellings and townhouses of any height. So single family homes, duplexes, townhomes, row homes, whatever you want to call them, are residential.

And then also, groups R2, R3, and R4, three stories or less. So if the building is three stories or less and it's one of these occupancies, which are found in the International Building Code, if you want to get more information on these. But I'll oversimplify a little bit. R2, you can think of as apartment buildings. R3 and R4 are care facilities, congregate living facilities, and they differ just based on the number of occupants that are going to be there and maybe the hours of operation. But I think largely for the sake of this presentation, we're talking about single-family homes, duplexes, townhouses, and apartment buildings. Apartment buildings three stories or less, I should clarify.

OK. So climate zones have changed since the 2009. I'll show another map that shows just the counties that have changed. But we have eight climate zones, technically 9, because there is also a tropical climate zone zero. These have been aligned now with an ASHRAE standard 169 that has climate zones. So the IECC now aligns with these ASHRAE climate zone standards, and that's why they've changed.

About 10% of the counties across the country have changed from one climate zone to another. Almost all of these are to warmer climate zones. Not all of them, but the majority of them are going from colder to warmer climate zones. And typically, these affect your building envelope requirements in terms of insulation levels and also your maximum air leakage rate. So the primary and perhaps only ways that climate zone is relevant on the residential side.

So this map is showing those counties that have changed. The ones in red have gone to warmer climate zones. The ones in green have gone to colder climate zones. So I won't really go through them, but you can find where they are on this map, or you can go to the table, excuse me, R303.1, which has a whole list of by state and then by county within each state. So you can find what your current climate zone is that way.

OK. So there are four main compliance pathway options-- prescriptive, total building performance. This was previously known as the simulated performance alternative. So that's what-- if you're familiar with the 2009, that's what it's called. The idea hasn't changed, but the name has changed. We have the energy rating index option that was new starting with the 2015 IECC, and a new section that we call these options. But really, if you're in a tropical region, these are like Hawaii and US territories, island territories. This is a new section that has its own requirements. And it's not really an option if you're in those areas.

Those are the four main options. You also have to meet this new section additional energy efficiency. I'll explain what that means. But regardless of your compliance path, you have to choose one of these five options and implement that in the building. And then there are also mandatory requirements that apply across the board, regardless of which one of these four main compliance options you take.

Also worth noting that within the prescriptive path, there are essentially three different options you have in terms of your installation. There's an R value table. So you just meet the R value and window and door U-factor. Requirements at those levels or exceeding those levels, you're good to go. It's simple. There's just not a lot of flexibility to it.

There's a U-factor table also that you can-- it's like having trade offs within a component. But say you have a structural insulated panel that it doesn't have any

framing, interrupting the insulation, you might be better off using the U-factor table instead of the R value table. So it provides a little bit more flexibility.

And then there's UA trade off. That stands for U-factor times the Area, and this allows trade-offs between envelope components. So for example, if you want it to be below the prescriptive R values for-- excuse me, for wall insulation, but you're good with putting in better windows and that offsets the energy penalty from being below code on-- below prescriptive code on your walls, as long as everything comes out overall for your entire building envelope or building shell, then you're meeting the code. So you can trade off between your walls, roofs, floors, et cetera.

OK. And we'll do more on the energy rating index towards the end. Total building performance hasn't really changed, but just know that these two options are both energy-modeling approaches. So you're simulating energy use, and that's just really the output that's a little bit different.

OK. So one of the mandatory requirements that applies across the board is a permanent certificate. This has been a requirement all along since the 2009, that you have a certificate somewhere in the house. The language has changed a little bit about where it is, but you're basically enabling the homeowners or prospective homebuyer at some point in the future to have a little bit more information about the efficiency characteristics of the house.

So this label has to be posted near the furnace. Really, it should probably say air handler, because it's not always going to be a furnace, in a utility room or other to prove-- other approved location inside the building. Approved throughout the code just means that it's acceptable to the code official.

And the things that need to be on there are listed here. The ones in gray are not changes and the ones in the dark blue are changes. So I'll just run through these quickly. We are required to list the predominant insulation R values for all of the different assembly types, predominant window U-factors and solar heat gain coefficients. No changes with those two.

New, as compared to the 2009 IECC, you need to have duct testing results on there, as well as your envelope testing results. And then not new is the equipment types and

efficiencies are to be listed on this label. What is new is the size of the equipment is now required to be on there. So your output capacity in BTUs or tons.

If there is a photovoltaic system, so solar electric system, you are required to list certain information about it-- the capacity, inverter efficiency, panel type, and orientation. That's only if applicable. There's no requirement to have solar in the code. But if you do have it, you are required to list out this information.

The energy rating index score, again, if applicable. That's only the builder has chosen that path. And the code edition, so which code you are complying with. Which is a little bit tricky. I was thinking about this with the HUD requirement because you might be on the 2009 IECC, and you should really probably have a label that says 2009 IECC for code compliance purposes. But you'll need-- the builder will need to certify that it is also meeting the 2021 IECC requirements.

All right. So that first section of the chapter for residential is the building thermal envelope section, in other words, insulation and air sealing. So we're talking about the boundary between our conditioned space inside and the great outdoors or an adjacent unconditioned space like a vented attic or vented crawl space or an unconditioned basement.

All right. So these are the items that are protecting us from the elements in terms of window performance, the metric that we're looking at is U-factor. Fenestration is just a fancy term for an opening. So basically includes windows and doors together. Skylights are listed separately, but not included in this presentation.

So these values have changed across the board, regardless of climate zone. And I'll take a minute on this one just to go over the format of this table, because I'm going to use this again and again. But we have the climate zone in the first column here going from the warmer climate zones to the colder climate zones down at the bottom. And then the values as they were in the 2009 IECC in the middle column, and then the values of the 2021 IECC in the right hand column. And we've highlighted the ones that are changes from the 2009.

So there was no climate zone zero previously. So those are always going to be highlighted. So I don't think I'll say that again and again. But otherwise, we have climate zones 1 through 8 have existed in the past, and we'll review the changes there. So

some pretty significant jumps in terms of the U-factor, which, by the way, U-factor is thermal transmittance.

So basically, it's how easily heat flows through the material. You can think of it as how well insulated the window is. And a lower value means that there's less heat transfer. So we can think of the lower the value, the better. And you'll notice that these values go down as the climate zone gets colder and colder because it becomes a more important factor for efficiency.

But we've gone from a 1.2 and climate zone 1 to a 0.5. Climate zone 2, 0.65 to 0.4. Climate zone 3, 0.5 to 0.3. And then all the rest have gone from 0.35 to 0.3. So that's climate zones 4 through 8 have taken that modest jump. Also worth noting that all of these can be accomplished with double pane windows. Once you go below 0.35, we're talking about low E coatings. But we're not really talking about anything that is. Different from what's widely available on the market.

And in fact, they're significantly less stringent values than is required by ENERGY STAR. And so these two tables are comparing the 2021 IECC with the ENERGY STAR requirements. Note that the climate zones are flipped here of the northern climate zones at the top and the southern at the bottom. We did that to match the ENERGY STAR table.

But you can see there's different paths for the northern climates, but ranging from a youth U-factor of 0.22 to 0.26. So the ENERGY STAR values are significantly more stringent than the code values. And according to Andersen windows-- I was poking around the internet-- they're saying that the easiest pathway is most likely for ENERGY STAR requires triple pane glass. So ENERGY STAR is staying well ahead of the code at this point.

Northern climate, sorry, north-central, as ENERGY STAR calls it, corresponds with climate zone 4 in the IECC. So you can compare the 0.3 in the IECC with 0.25 ENERGY STAR. 0.3 in climate zone 3 to 0.28 in the south-central for ENERGY STAR. And then 0.4 or 0.5 for climate zones 2 and 1, and 0.32 is the U-factor for the southern for ENERGY STAR. So again, the nutshell is ENERGY STAR still exceeding the code, and you can achieve all of the code values with two panes of glass.

The other factor impacting efficiency with Windows is the solar heat gain coefficient. So this is a ratio of the amount of heat from the sun, radiant heat from the sun that strikes the window and enters the home versus is reflected back out to the outside. So it's a percent. So it's always between 0 and 1, and closer to 0 means that there's less radiant heat passing to the inside.

So generally, we can think of lower as being better. Although in northern climates, sometimes there are advantages to having a higher solar heat gain coefficient, but we'll think of it at lower as better as a generalization. And the values are shown in this table. We have our new tropical climate zones at 0.25, and that same value 0.25 carries all the way through climate zone 3. So down just slightly from the 0.30 previously.

Climate zones 4 and 5 in the 2009 did not have a requirement. That's what this NR stands for, No Requirement. And actually, 4 through 8 had no requirement. But as of the 2021, there is a requirement of 0.4 SHGC or less in climate zones 4 and 5. Another comparison with ENERGY STAR. It's kind of interesting, actually.

ENERGY STAR is requiring at least certain solar heat gain coefficients for the northern climate zones. Instead of having a maximum, they have a minimum, because it can help with your heating loads. But better to focus more on the more southern climates. But climate zone 4 and the north-central climate zone are aligned at 0.4 or less. IECC climate zone 3 and south-central are pretty close-- 0.25 in the IECC and 0.23 in south-central for ENERGY STAR and then 0.25 for climate zones 0 through 2, which aligns with the southern climate zone, also 0.23 for ENERGY STAR. So those are all pretty close.

OK. So moving on from our windows and doors, we'll go through the other thermal envelope components, starting with sealing insulation. This could either be on essentially the attic floor or it could be on the roof line, depending on the design. But you can see how the values have changed here. R30 and climate zone 0 and 1, it's gone from R30 to R49 in climate zones 2 and 3.

Climate zones 4 and 5, we've gone from an R38 to an R60. And climate zone 6 through 8, we've gone from R49 up to that same R60 value. This has been one that has been one of the more controversial items. There are ways around this, as we mentioned. You can do the option or simulated performance or total building performance as it's now called, and you don't necessarily have to meet these values.

And that's the intent behind those alternative pathways to begin with. Is if you don't like something that's in the prescriptive path, you can find it-- and think you can find a more cost-effective way of doing it, that's fine as long as it comes out as being equivalent to the building envelope overall.

OK. Wall insulation. So this is for wood framed walls. May not get a lot of steel, although perhaps you do in some of the multifamily settings. But there is a separate table that has conversions for steel framing. But for wood framed walls, we have a couple of different values here. So I'll just point you to the 2021 IECC column and explain the nomenclature here.

There's R13. This first value in all these cases is a cavity insulation R value. So this is insulation that's in between framing members, so in between the studs, the wood studs in this case, and so it's interrupted by that framing. The value on the right has a CI, and that stands for Continuous Insulation.

So that would be insulation generally installed on the exterior out outboard of the framing and the sheathing. And it's continuous, meaning it's not interrupted by the wood framing. So it is continuous across the entire wall surface. So you have the option of doing 13 in the cavity or 10 continuous in climate zone 0 through 2.

And that's not really a change other than they've explicitly called out the option of having the R10 continuous. Climate zone 3 has made an improvement. It's gone from R13 in the cavity up to R20 cavity, or you have the option of doing 13 cavity plus 5 continuous, or, and this is perhaps unlikely, but you're going to have the option of R15 continuous insulation if there's nothing in the cavity.

And you might have that with SIPs, although I'm not sure if they fall under the heading of a wood frame walls. But anyway, you have a variety of options-- cavity, cavity and continuous, or continuous only. So they've added flexibility even as they've made efficiency improvements.

Climate zone 4 through 8 all have the same basic requirements in terms of the insulation are the 2021 IECC, but they've made more of a jump in climate zone 4 especially, which went from just 13 cavity to 30 the cavity only. Again, perhaps pretty rare, but maybe could do it with a closed cell insulation or double wall, something like that.

Our 20 cavity plus 5 continuous insulation, 13 plus 10 continuous, especially as you move North-- I'll just do a little public service announcement-- you want to have more of that insulation to the outside. So northern climates, you're from a condensation risk perspective, better off doing 13 plus 10 versus 20 plus 5, but we could do a whole session on that. Or 20 continuous is an option in climate zone 4.

Climate zones 5 and 6, going from 20 cavity or 13 plus 5 to the same values that I just described, 30, cavity only. 20 plus 5, 13 plus 10, or 20 continuous only. And that's the same for climate zone 6 and 7 and 8. Same thing, but they were already up at an R21, which you could do with a high-density fiberglass batt, for instance.

So that's the whirlwind tour of wood frame wall insulation changes. Again, I'll reiterate, these are only the prescriptive R-value requirements and you don't have to meet all of these values if you can achieve compliance through an alternative pathway generally involving some type of software. OK.

So next is mass walls, and these are above grade walls. The code defines these as more than 50% above grade, so above the finished grade line. And it's also made of concrete, concrete masonry units, brick, solid timber, or logs. A couple of different earthen products that are out there.

But these are differentiated from your framed walls that we covered in the previous section, because these are dense-- made of dense materials, which has a energy benefit in certain cases. Another nomenclature issue here, note that the second value here applies when more than half of the insulation is on the interior.

So without getting into the building science on this, the insulation or the wall will perform better if more of the insulation is on the exterior. So typically, your values-- if most of the insulation is inside, your R values are going to be a little bit higher. So just a note on what the two different numbers mean.

So it's either three or four, not a huge difference in the warmer climate zone 0 and 1, 4 or 6 in climate zone 2, 8 or 13 in climate zone 3, same with climate zone 4. And these have all gone up marginally from the 2009. No change in climate zone 5. We have 13 if you have more than half on the inside-- sorry, outside, and 17, more than half on the inside.

Climate zone 6, essentially the same. They just went from an R19 to an R20 if half your insulation is on the inside. And then climate zone 7 and 8, way up North, 19 or 21, depending on the location. All right. Floor insulation. So this would be insulation in floors over an unconditioned basement or a vented crawlspace, also cantilevered floors that are over outside air.

Not a lot of changes here. The only thing that has changed is that there is a new climate zone. So the insulation requirement exists where it didn't before for the tropical climate zones. Otherwise, no changes. R13, climate zones 1 and 2. R19, climate zones 3 and 4. And then R34, climate zones 5 and 6. And all the way up to R38 for climate zones 7 and 8.

In the off chance that your framing is not very deep, at least in climate zones 5 and 6 where the R30 requirement is, there is a footnote that lets you go down to R19 as long as you're filling the entire cavity that applies to the R38 as well. But in most typical construction, you're not going to be going all the way down to R19.

Basement wall value. So this could be insulation on the inside or the outside. It's to extend from the top of the wall down 8 feet or to the floor, whichever you hit first. And there's no requirement for insulation, and there hasn't been a requirement for climate zones 0 through 2. No changes in climate zones 3 or 4. The nomenclature has changed a little bit, but the actual result is the same. 5 continuous or 13 cavity or climate zone 4.

It's 10 continuous or 13 cavity for climate zone-- I think I just misspoke. Five continuous or 13 for climate zone 3, 10 continuous or 13 cavity for climate zone 4. And then climate zone 5, we add an additional option that has a combination of cavity and continuous. So it's 15 continuous only, or 19 cavity only, or 13 cavity plus 5 continuous. So it starts to become a little bit of a mouthful here.

Climate zone 6, same requirement as above. It's not as big of a-- it's not really a change from the past. Same with climate zone 7 and 8. Not a change other than they've added the option of doing 13 plus 5. But you could have done all along if you chose the U-factor alternative or use the UA alternative. But now they're explicitly giving you that option in the prescriptive R value table. So that's basements, and these are walls that are more than 50% below grade.

Slab insulation. So we're talking about the slab perimeter. There is a requirement to have under slab insulation only if you are having a heated slab, like, a radiant heating type system where the heating elements are in the slab or underneath the slab itself. But any number of ways of actually accomplishing this insulation. It can be on the inside. It can be on the outside. And there's an R-value requirement is one component, and then the depth is the second component of the slab insulation requirement.

So no slab insulation requirements for climate zones 0 through 2. Climate zone 3, this is a significant change because it went from having no slab insulation requirement to having one and aligns with the rest of the country in terms of the R value. That's R10 continuous insulation, and it's to extend a depth of 2 feet. And that can be a combination of vertical and horizontal insulation. The key point is that it extends down from the top of the slab.

And then elsewhere in climate zones 4 and 5, the R value hasn't changed. Still R10, but it's gone from two 2 in depth to 4 feet in depth. So doubling the amount of insulation there. And then no changes for climate zone 6 through 8, 10 continuous with a depth of 4 feet. And I should say I should have said this up top. We could do a whole day or two days on this, but just covering the highlights here.

OK. Crawlspace wall insulation. We have unvented crawl spaces. So these are not like traditional crawl spaces that are vented to dissipate some of the moisture. These are more and more common. Building scientists think generally would consider them a more durable, efficient way of doing a crawl space. But these are where you're going to be insulating the walls and not having any ventilation to the outside.

I'm probably going to have to speed up a little bit here. But no changes for climate zone 0 through 4. Climate zones 5 through 8 have gone from 10 continuous or 13 cavity to basically matching the same values that we went over for the basement walls. OK. So that was our insulation R-values and fenestration U-factors.

Now we'll get into air leakage and, I guess, still talking about insulation to a certain extent. But there is a section with air barrier and insulation installation criteria. Under the 2009 IECC, we had this section or you could do a blower door test or envelope air leakage test, in other words.

Now in the 2021 IECC for the HUD requirement, it is both. This change actually happened in the 2012 IECC, so it's been around for a while as far as the model code is concerned. But you have to meet the requirements that are in this air barrier and air sealing and insulation installation table, the name is changed a little bit, and you have to do an envelope air leakage test. So prescriptive and performance requirements there.

And you're not intended to read these, but just to give you a glimpse at the tables. 2009 had the components in the left-hand column and then a description of the criteria that had to be met. I flipped my left and right. And the left is the component, and the right is the criteria. And then in an intervening code cycle, they change it. So you have the component on the left, you have an air barrier criteria in the middle, and then your insulation installation criteria on the right.

There have been some minor changes. But overall, I'd say the impact of that has stayed largely the same. They've just gotten a little bit more detailed and more specific. And we'll get into the maximum air leakage rates on the next slide. But if you're not familiar with a blower door test, this is how we're testing the amount of air leakage that we're having in our house.

So we are going to use a fan that's installed in a door to the outside, and then this red arrow is indicating that we're pulling air outside the home. So the span is-- you can do it either way, actually. But in this case, we're pulling the air outside the home, and that's creating negative pressure inside the house. We're bringing it up to a test pressure of negative 50 pascals, and these blue arrows are just indicating that negative pressure.

And so air is going to be pulled in by that negative pressure, and then pass through this fan and we can measure the amount of air that's moving through this fan at the test pressure. So we get what's called a CFM50, Cubic Feet per Minute at 50 pascals. Ultimately, the code asks for ACH50, which is air changes per hour at 50 Pascal. So an air change is when the entire volume of the conditioned air is replaced by Outdoor air.

And so there'll need to be a conversion. So getting a little bit into the weeds here, and some of the gauges and things are getting pretty fancy. But you'll have to know the condition volume of the house and do this conversion from CFM50 divided by the condition volume times 60 to get it into the same units that the code maximum rates are in.

And then over on the left here, we have a digital manometer. The one on the bottom is the latest, greatest version of this. They've changed over the years from magnetic gauges with little needles and things to much fancier computer-driven versions. But in any case, you have a gauge that's measuring your pressure and flow and a big fan. That's a variable speed that you can crank up until you hit the test pressure.

So the leakage rate under the optional blower door test or optional air leakage testing was seven in the 2009 IECC, 7 ACH50. Now testing, as I said, is mandatory for all homes. Climate zone 0 through 2, your maximum rate is 5 ACH50. Climate zones 3 through 8, it goes down to 3 ACH50. Although up to 5 is allowed in climate zones 3 through 8 if you're using the performance or ERI paths.

That said, air ceiling is probably one of the more cost-- is one of the more cost-effective ways of improving the efficiency. So under the performance path, it's probably not going to be recommended to exceed the 3 ACH50. But you have that wiggle room. An entirely new section as compared to the 2009 is rooms containing fuel burning appliances. So we're talking open combustion equipment like furnaces and water heaters, gas, oil, propane.

But rooms containing these fuel burning appliances, sometimes other codes, there's the chapter in for fuel gas, that in certain circumstances would require a source of outside combustion air for the safe and effective operation of that equipment. That's what we're showing here. Let's say this is a water heater, and the other code is requiring-- the International Residential Code is requiring air to be brought in from the outside.

And so if we have a conditioned space here and we've done all this air sealing, it doesn't make a whole lot of sense to then poke a giant hole and let air in. But you need that air to operate this equipment. So the IECC has requirements now that prevent this from being a big energy penalty, and you essentially have to enclose that equipment and the outdoor air within an insulated and air-sealed room. And there are certain R-value requirements. And it just says that it has to be it has to be air sealed. And the duct also has to be insulated if it's passing through a conditioned space to get into this insulated room.

Direct then appliances, you're good to go because there-- you don't need this because they're bringing air directly from the outside and exhausting back directly to the outside. Electrical and communication boxes is a new requirement to have air sealed type. So

there's a NEMA rating for those, and they will need to have a mark on them that indicates that they are NEMA OS 4, or simply OS 4. So they're airtight. You get a lot of air leakage through your receptacles because you have a lot of them.

So that's envelope. Moving into HVAC, Heating, Ventilation, and Air Conditioning or Mechanical Systems, as the code calls it. A duct leakage testing has been around in the 2009 IECC. But one big difference under the 2021 is that the leakage to outdoors option is gone. We're now always talking about total leakage. Won't get into the difference there, but we're testing the leakage of the system regardless of where that air is leaking to.

And the rates have come down significantly as well from the 2009 level. So 12 CFM down to four CFM. And you have to go even lower to three CFM if you do the test without the air handler installed. Another big change here is the 2009 IECC had an exception. If all of the ducts and the air handler are within conditioned space, but that exception goes away. And you do need to test the ducts no matter where they are located. Even if they're all inside, we're still doing the test. That said, you do have a higher maximum allowable rate at 8 CFM per 100ft of conditioned floor area.

OK. Building cavities used as ducts. The 2009 IECC said the building cavities shall not be used as supply ducts. They crossed out that word starting with the 2012 IECC. So now they may not be used as supplies or returns. So this, with the padding material, is not acceptable anymore. Under the HUD requirement, you'd have to hard duct, so to speak, all of your returns.

Hot water pipe installation, a variety of circumstances where you need to have R3 pipe installation. And so this is on our domestic or service hot water piping. So R3 if you have piping 3/4 inch diameter or larger. Piping serving more than one dwelling unit. Piping located outside condition space. That's regardless of its diameter piping from the water heater to a distribution manifold. So that section in between the tank and a home run system.

Piping located under a floor slab, piping that is buried, and supply and return piping in circulation and recirculation systems, I'm not sure what the difference is, other than cold water pipe return demand recirculation systems. In the interest of time, I won't belabor that point. OK. Whole house mechanical ventilation is required. That kicks in because of the International Residential Code requirements.

You can do exhaust-only, supply-only, or balanced systems, and they can either operate continuously or intermittently on a preset schedule. And there are, like I said, a variety of ways of accomplishing that. But the code specifies minimum rates, and the IECC simply refers you out to the International Residential Code or the International Mechanical Code, whichever is applicable where there is an equation that's used to calculate your minimum ventilation rate, or you can use a table that-- if you don't want to do the math, you can use the table.

And I'm not going to-- because am short on time, I'm not going to get into that. But just know that there are minimum ventilation requirements that do kick in as we are building tighter and tighter homes. Heat recovery and energy recovery ventilation, this one only applies in climate zone 7 and 8. So way up here in North Dakota, Minnesota, the tip of Maine, Alaska where you are required to have heat recovery or energy recovery ventilation that's going to capture some of that heat that you would otherwise exhaust to the outside and reintroduce it back inside. And then there are efficiency requirements for that sensible heat recovery efficiency of 65% at 32 degrees.

Whole house dwelling ventilation efficacy. So it's the Residential Code, International Residential Code or International Mechanical Code, that requires that you have whole house ventilation. But the energy code kicks in telling you that you need to be using an efficient fan. So efficacy is in CFM per Watt, so how much air can you move per Watt of electricity.

And all of this is new. I was not in the 2009 IECC or that suite of codes, 2009 I codes. This table has the fan location or type of fan in the left-hand column, the airflow rate of that fan, and then what your minimum efficacy is, which depends on the airflow rate and the type of fan that you're using. So if you have an HRV or an ERV, 1.2 CFM Watt is your minimum. In-line supply or exhaust fan, 3.8.

Other exhaust fan that's less than 90 CFM is 2.8. Any other exhaust fan that is greater than or equal to 90 is 3.5. And if you have an air handler integrated system, so you're piping air in from the outside to the return air system of your heating and cooling system, in that case, your fan has a minimum efficacy of 1.2 CFM per Watt. So the fans must meet these minimum efficacy requirements, and the other codes give you-- tell you how much ventilation you need to have.

Another significant thing, in addition to having the testing or to having the ventilation in the first place, the 2021 IECC introduces the requirement to test the airflow. So you actually are documenting that you're getting the minimum required airflow rate. So there's a few different ways of doing that. But this was introduced into the code because of what we're seeing here with the picture of the fan housing.

And then there's 180 degree turn right out of the fan housing, which really restricts the airflow. And any number of things can cause that restriction in airflow. And pretty well documented that these problems exist widely. And so we have this requirement to test to make sure that not only are we installing a fan that's capable of moving the minimum amount of air, but it is actually installed to operate at that level.

All right. Lighting, this is a pretty short section. High efficacy lamps are required. In the 2009, it was 50% of high efficacy lamps. In 2021, it's now 100% of the lamps have to be high efficacy, excluding kitchen appliance lighting. So you have that limited exception there. I think the market has pretty much gone faster than the code in this case. So your LED lights will satisfy this requirement.

And they've changed the definition of high efficacy slightly since the 2009 with the current definition under the 2021 is lamps that are greater than or equal to 65 lumens per Watt or fixtures that are greater than 45 lumens per Watt. So a lamp is synonymous with a bulb in common parlance, and a fixture is a fixture that might contain multiple lamps or bulbs.

Exterior lighting, this is-- the 2021 IECC is the first time exterior lighting has been mentioned in the residential provisions of the IECC. Basically, it's closed a loophole for low rise apartment buildings where there were no exterior lighting requirements. So you have to go to the commercial chapter, that gives you your lighting power allowance for commercial, or you're 100% high efficacy is the nutshell.

But 1 in 2 family detached dwellings townhouses are accepted from this solar powered lighting-- if all the lights are solar powered, you don't have to meet those requirements. If you have motion sensors, so they're only on when somebody is moving around, or as I said, if they're all high efficacy. So if you have LED lights, then you don't have to worry about going out into the commercial code and calculating your lighting power allowance.

Lighting controls have been introduced into the IECC for the first time with 2021 IECC. Says that permanently installed lighting fixtures shall be controlled with either a dimmer an occupant sensor or a control installed or built into the fixture. So several options there. You have to have them everywhere in the home, all the different rooms, except for bathrooms, hallways, the outside, and-- because they have their own requirements, as we'll see-- and lighting design for safety and security.

Moving back outside, we talked about exterior lighting power. Now we're talking about exterior lighting controls. Here, where the total permanently installed exterior lighting power is 30-- greater than watts, so more than watts of lighting on the outside of the building, then you have to meet these requirements. So in a nutshell, we want to make sure that the light isn't on when you have enough light from the sun. So lighting shall be controlled by a manual on and off switch, permits automatic shut off action, except for if it's serving multiple dwelling units.

It also has to automatically shut off when daylight is present and satisfy the lighting need. And you can have an override, a manual override to that, but it has to kick back into the automatic controls within 24 hours. So the lights are not on when we don't need them.

OK. Our last section here, additional efficiency package options. And I may not go through the details of this so we can take a few questions. But you have to choose from one of these five options and implement that in your building under the prescriptive path. So we have enhanced envelope performance, a little bit better insulation values, more efficient HVAC equipment. So they provide the efficiencies in a later section.

Reduced energy use and service water heating. So that's either solar water heating or efficient water heaters. More efficient duct thermal distribution systems, either ductless systems or all your ducks are inside. Or improved air sealing and efficient ventilation. So basically, to have a heat recovery or energy recovery ventilation. So you choose any one of these five options and you meet this section.

Performance path is a little bit different in that you can either meet one of these five options and then not include it in your energy modeling, or you can just do your energy model and get 5% better than the reference home. Or in the ERI path, you have to be 5% better than the maximum ERI table that's listed. And am going to just flip through these. These will be in the slides that you can review later.

Performance path is a software simulation that incorporates a variety of different energy characteristics, all of the energy code covered characteristics of the building. Energy rating index, you're basically doing the same thing. But it spits out a score instead of a energy cost. And the same software programs that you may be familiar with if you're doing Hirsch ratings or ENERGY STAR or meeting 45L tax credit requirements. So APEX, Ekotrope, EnergyGaugeUSA, and REM/Rate are examples.

Total building performance, your energy cost has to be-- of the proposed home has to be lower than or equal to the energy cost of a reference home that's same size and shape as your proposed home. And then that ERI path, bunch of software inputs. You tell the areas and the installation requirements and air sealing levels and et cetera. And then it will spit out a score.

100 is a home equivalent to the 2006 IECC. Every point below that is a percent better. So 2021 IECC is down here around the 55, 50 level. But then you have to do 5% better than the original table. So it's a little bit strange how it came out in the process. But these are ultimately the values that you'll have to be at or below under the ERI path.

Certifying compliance with the 2021 IECC. So HUD requires builders to certify that the homes meet the 2021 IECC, meet their requirement. So builders should verify that the construction documents are meeting the requirements of chapter 1 information and construction documents, and that the home is designed to meet the 2021 IECC.

Likewise, there are required inspections in chapter 1 that the code lists as what the code officials are required to do, but builders should do their due diligence and make sure that the homes are also being built to the 2021 levels. And assessing code compliance-- and this is different than perhaps you've been doing under the 2009 IECC.

But assessing code compliance requires individuals with specialized knowledge or equipment for things like duck leakage testing, envelope air leakage testing, even the air sealing and insulation installation criteria. You have to know what you're doing. And in the case of the testing, you have to have the equipment to be able to do that. So just a note. If you're not already doing blower door testing, duct leakage testing, these are going to be requirements that are coming in under the HUD requirements.

And in terms of the folks that are out there doing these types of testing and inspections, there are a variety of certifications that require some demonstration of knowledge and

knowing how to operate the equipment. A few examples here. HERS rater, that's the Home Energy Rating System, Ratings Field Inspector, which is kind of a offshoot of the Home Energy Rating System certification. IECC/HERS compliance specialist. And there's a Building Performance Institute, or BPI, Infiltration and Duct Leakage certification that meshes well with the IECC. So if you're interested in finding somebody that knows what they're doing, there are a few examples of certifications there.

OK. I'll read my summary, and then we'll have just a few minutes for questions. But climate zones have changed. 10% of the zones have shifted, mostly from colder to warmer. There are four different compliance paths-- prescriptive, performance, ERI, and-- what am I missing-- the tropical path.

Chapter 4 has changes in the building thermal envelope, so improved R-values and U-factors. There are air bearing insulation installation criteria. Air tightness testing is required, and the leakage limit is lower than in 2009. Mechanical systems. Building cavities may not be used as any kind of ducts, including returns.

Duct leakage testing, the options are limited and the limits are lower, and you have to test even if all the ducts are inside. Hot water piping insulation requirements. Whole house ventilation is required, and you have to test those systems. HRV/ERV for climate zone 7 and 8 only. Interior lighting. 100% high efficacy plus dimmers or occupancy sensors. And we have exterior lights that shut off when daylight is present.

And finally, we have the additional efficiency packages that we reviewed. Choose one of five and carry that out, and then you satisfy this requirement. So not all five, but just one of those five options. OK. I will catch my breath and see if we have any questions here.

Great. Thank you so much, Mike. So we're going to move into Q&A. Before we do, I just wanted to bring your attention to the minimum energy standards page on the HUD Exchange. So this page provides just a variety of resources and training materials that will assist you on the requirements of the updated minimum energy standards.

So it includes introductory code resources, links to compliance tools like COMcheck and REScheck, which are software applications that can assist builders, designers, and contractors in demonstrating code compliance. We have state level energy code resources like this map that we keep referencing. And there's also information and links

to technical assistance and funding opportunities, including some of what Mike mentioned on DOE's building energy codes program resources.

So take a look at that. I want to remind you guys that the slides and recordings of this webinar will also be posted to HUD Exchange. I'm sure there's a lot of information that you guys are going to want to revisit. And with that, let's move into some questions. So Drew, I think this question is for you. The first question is, has a cost benefit analysis been completed that shows the cost of meeting the required code compared to the cost benefit?

Yeah. So great question. Obviously, today and really through this webinar series, we're a lot more focused on implementation. But to get to the final determination, as I mentioned at the beginning, there was an extensive amount of analysis that went into that determination. So we do have all the information for the affordability and availability testing that went on in the final determination that's published on the Federal Register as well as the accompanying Regulatory Impact Analysis, or RIA. So you can find all of the details that went into the determination to adopt these standards there.

Excellent. Next question also for you, Drew, how do you HUD and USDA compliance dates interact? So if, for example, a project stacks HUD and USDA funding like home and 502 direct, for example, when will it be required to comply with the updated code?

Yeah, another great question. So particularly with the or specifically with the home and housing trust fund programs, if funds are being stacked with home or HDF and another impacted program, the later compliance date will apply. So obviously, going through the list of compliance dates at the top Home and Housing Trust Fund went into effect last week.

But if you're stacking funds with another impacted program that has one of those compliance dates 12 or 18 months out, it'd be that later compliance date that you're paying attention to. And additionally, want to just remind folks that there is the extended compliance period for all projects in persistent poverty rural areas, which the map of persistent poverty, rural areas can be found on USDA's website. That doesn't go into effect until two years out after the effective date of May 2026.

Excellent. Thank you. I think we have time for one more. So the question-- I know we talked-- Mike, you talked a little bit about this right at the end of your presentation, but

will builders self-certify compliance to code or will third party certification be required? Drew, maybe start with you. Mike, maybe you can weigh in.

Excuse me. Yeah. So happy to. So in terms of any program requirements here, really, it looks the same as what it does with the previous 2009 IECC requirement or ASHRAE 2019 or ASHRAE 90.1 2007. For some programs, FHA specifically, it's a builder self-certification form over home.

And Housing Trust Fund does have different requirements, so they're looking for grantees or PJs to conduct construction inspections, which is required by the program and include consideration of the applicable energy standard elements there. And for more information on the Home Housing Trust Fund requirements, you can actually take a look at the webinar that we did in November, which is specific to the requirements for Home and HDF.

I have nothing to add.

All right. Well, we are at time, unfortunately. I know there were some questions coming in at the end. So thank you, everyone, for joining us. Thank you, Mike Turns. Thank you, Drew. That was excellent information. And so, again, feel free to take a look at these slides and the recording once they're posted. And we will see you next week for the ASHRAE 2019 90.1 webinar. Thanks, everyone.

Thank you.