Residential Requirements of the 2009 IECC
10:00 am Pacific Time

Rosemarie Bartlett: Welcome, ladies and gentlemen. I'm Rosemarie Bartlett with the Pacific Northwest National Laboratory. I'd like to welcome you to today's Webcast, Residential Requirements of the 2009 International Energy Conservation Code brought to you by the U.S. Department of Energy's Building Energy Codes Program. At this time, all participants are in a listen-only mode.

Before we begin the Webcast, we will conduct a polling session. We have one polling question for you today. To answer the question, you'll need to press the numbers on your touchtone phone. Please wait for the entire question to be read before responding. There will be a brief 10-to-15 second period of silence after the question has been asked so that the results ca be compiled. Please remain on the line. The question is: How many attendees are at your location viewing the Webcast together? Please use the appropriate number on your phone to represent the number of viewers at your site. For example, press one for one viewer; two for two viewers, and so on. Please press nine to represent nine or more viewers. Once again, the question is: How many attendees are at your location viewing the Webcast together? Please use the appropriate number on your phone to represent the number of viewers at your site. Please answer now by using your touchtone phone. Please remain on the line during the silence while the results are compiled. Thank you. This concludes the polling session.

A couple of logistical announcements before we begin: You may ask a question at any time during the Webcast today by using the Q & A menu on your computer. Questions will not be answered via the computer but will be answered

live by the presenter as time allows at the end of the presentation. Those of you who want AIA credit or a certificate for participating in today's Webcast will need to write down the link that will be provided at the end of the presentation today. We're very happy to have as our speaker today Todd Taylor of the Pacific Northwest National Laboratory. Todd, please begin.

Todd Taylor: Thank you, Rose, and welcome everyone. As Rose mentioned, we are talking about the residential portions of the 2009 International Energy Conservation Code, IECC, today. We will jump right into it. To begin with, let's briefly kind of overview what this code is. This is one of a fairly large family of codes that the International Code Council puts out. We call them the I-Codes. The additional codes that are out there include all your plumbing codes, your building codes, mechanical, etcetera, and of course our interest today is the Energy Conservation portion, the 2009 in particular. There are - - there is one other code. You'll notice the blue picture at the top right there, the International Residential Code also has some energy provisions in it. Chapter 11 contains those energy provisions, and they are in many ways very similar to the IECC's requirements but there are some differences. So I'll talk briefly about the relationship between the two. The IECC addresses energy efficiency only, whereas the IRC is a full stand-alone code for all matters related to residential buildings, where residential is restricted to one and two family dwellings and townhouses that are three stories or fewer. The IECC addresses both residential and commercial and would include some residential buildings that are not included under the IRC, in particular, apartments and that sort of thing that are not covered in the one and two family dwelling code, you might call it.

The energy efficiency requirements in these two documents are almost identical. There are a few differences in stringency. I've listed the two primary ones here. The IRC only has a 0.35 solar heat co-efficient requirement in the southern three zones, whereas the IECC requires a bit more stringent 0.3. There are a few foundation requirements that are less stringent in the northern zones in the IRC. There are some other differences that are relatively minor in terms of energy consumption, but that's all we'll talk about there. We are focusing today on the IECC and, in particular, we're focusing on Chapter 4 of the IECC, which relates to residential energy efficiency.

If you are familiar with prior versions of the IECC, in particular with the 2006, I'll cover briefly a few of the things that have changed since then but we won't focus on those. For most of this presentation, we will assume that you have no knowledge of the codes at all, so you won't need any past history here. In the 2009 edition, some of the envelope requirements got a bit more stringent. I won't go into what those are. More importantly, there were several new requirements added, and these really, the early ones of these I'll mention are some of the more significant changes that have ever made it into the IECC in terms of saving energy. There is a requirement new in 2009 for pressure testing of ducts in buildings. Unless the ducts are completely inside condition space, there's a requirement that they be pressure tested to make sure that the ceiling requirements have been met. There are some similar new requirements related to envelope air sealing. You can either test the whole house with a blower door, do a pressure test, or there's a fairly extensive checklist that must be inspected bit by bit by the code official. The builder can choose either way to go there. There are, for the first time, restrictions on lighting in the 2009 IECC. There are some limits on the efficacy of the lamps that go into permanently installed

fixtures. There are a few new requirements for pools and snow melt systems that we'll talk about briefly as we go. Some of the moisture control requirements that used to be in the IECC, in particular the requirements related to vapor retarders in the building envelope have been moved over and the IECC now relies on provisions in the IRC. Those have been modified there to permit more flexibility in the way vapor retarders are implemented. A big change in the '09 version of the code is that you're no longer permitted to trade HVAC efficiency against reduced envelope efficiency. That's a very new thing. It has some far reaching impacts in terms of how compliance is checked and just in terms of what the buildings are going to look like when they comply with this code. The performance path has some other changes as well that we won't go into today. For the most part, those would be buried in the software tools that you use to comply anyway.

To begin with, let's take an overview of the structure of this code and make sure we have a clear view of what's coming. Then we'll get into the details. We'll be covering things like the front matter of the code itself, what the climate zones are, the scope, what's covered, the general nature of the requirements and so forth. With regard to climate zones, the climate zones in the IECC as you see drawn here on the figure, are defined entirely by county boundaries. You can see each and every county in the U.S. is drawn on this map. Once you know the county in which the building is being built, you know which requirements apply out of the code. This is different from many codes of the past where you had to know the local heating degree days or cooling degree days or both. You no longer are required to know those climate parameters for any location within the continental - - or within the United States. What that means is the requirements within every county are homogenous. They're the same. You don't have any two buildings

that are subject to different requirements within a county. As you can see the numbered zones on the map here, there are eight temperature oriented zones. The bottom tip of Florida you see is climate Zone 1. As the numbers go up, you move generally north over on the east side of the United States. That general south to north variation kind of breaks down in the mountain states but still the eight climate zones relate to temperature. Those are crossed with three moisture regimes. As you see across the top of the slide here, the moist regime, also known as A, is for the most part the eastern half of the United States. The dry regime is the mountain states in the desert southwest. The marine is the strip along the Pacific Coast that has that marine environment. So those eight zones and three regimes give you a theoretical total of 24 possible zones; however, within the United States, only 15 of those combinations actually occur. When it gets to the residential requirements, which we're focusing on for the most part, the moisture regimes are not used in the residential portion, so it turns out that there are really only seven unique zones as far as the residential portions of the code are concerned. One other thing to notice, you'll see a white line snaking through the middle of Zone 3 in the southeastern part of the U.S. That white line defines what's known as the warm, humid counties. Those counties are based on ASHRAE's definition of a warm, humid climate. They are different from the moisture regimes. For the most part, they are not used in the code yet. The thing is there primarily to accommodate things like economizers in the commercial side of the code where humidity considerations are important. The only place that line is used in the residential code is with regard to basement requirements in Zone 3 where the warm, humid portions of Zone 3 do not have any requirement for basement insulation.

The scope of the IECC, we've already mentioned we're referring today to residential buildings, and I think I've already said the IRC energy chapter covers only one and two family dwellings and townhouses, whereas the IECC covers all low-rise residential, all occupancies except those that would relate to, for example, hotels and motels. So if you're going to apply a multi-family apartment building, for example, you must use the IECC rather than the residential IRC Chapter 11. Any building that is not residential, according to the definitions above, is defined as commercial in the code and would comply under Chapter 5, which we won't talk about today. The scope of the code does include repairs, alterations, and additions. We'll talk more about those in a moment. There are certain buildings that are exempted from the requirements of this code. Very low energy use buildings, those with - - that are designed to use overall less than one watt per square foot, for example, are exempted. Buildings or even portions of buildings that are not conditioned are exempt from this code. Existing buildings are exempt, meaning that if you purchase an existing home, you're not required to bring it up to the specs of this code simply because it changed hands.

Finally, there are some allowances for historic buildings so that you don't have to modify the historical esthetic aspects of the building to match this code. With regard to additions and alterations, renovations, this code applies to any new construction that goes in on the home; but it is not required that you bring the rest of the home up to the requirements of the code when you alter another portion of it. If you put an addition on a new home or on an existing home, you have your choice of either making sure that that additional room or whatever it is added to the home complies with this code on its own or you can demonstrate that the entire building, including the new portion, complies when it's all said and done.

That would typically involve the energy performance analysis path, which we'll talk about a bit later.

Finally, any unconditioned space in the home that is converted to be conditioned has to be brought into full compliance with this code. There are a few exceptions to additions and renovations with regard to applying the code to them. Applying storm windows, for example, over existing fenestration does not trigger a requirement that the blazing be brought up to the specs of this code. If you replace only the glass within a window, leaving the sash and frame in place, you're not required to bring the windows up to code. Basically, if you open up a building cavity and that cavity is already filled with insulation, you're not required to bring that up to the level of the current code. For example, if you open a wall that's - - 2 by 4 wall with R-13 in it in a climate zone where the 2009 code would require R-20, as long as you - - as long as that cavity is already filled with insulation, you're not required to bring it up to R-20. You can leave it at R-13, even if you opened it during the renovation. Other requirements or other allowances, anything that you don't open even though you're working near it, does not have to be brought up to code.

Finally, mixed-use buildings, there are a few of those out there, fairly straightforward in terms of scope. The portion of that building that has a residential occupancy is required to be compliant with the residential portions of this code, and the other portions of the building that would be considered commercial occupancy will have to comply with Chapter 5.

An overview of the general structure of the IECC, most of the requirements that people are familiar with are climate specific. In other words, for things like

insulation and walls and windows, ceilings, foundations, and so forth, those vary with climate. There are some other requirements in the code that are universal. They apply everywhere regardless of climate. Typically those are related to HVAC systems and so forth but also, excuse me, infiltration control systems, for example, are universal. The IECC has some terminology in it we need to get cleared up because it's not used in this manner in most of the rest of the I-codes. When the IECC refers to a requirement that is prescriptive, that basically means it's a required element of the code, but you can trade it down or even trade it away by increasing the efficiency of another building component. So, for example, if the code requires R-20 walls, you can trade that down and put in an R-13 wall if you improve some other portion of the building, the ceilings or the windows, in a manner that compensates for that change in efficiency. When the code refers to a requirement that's mandatory, that's a requirement that cannot be traded down or away under any circumstances, even in the full performance simulation path, so those terms will be used several times as we go through this presentation. You need to remember what they mean. There are a few elements in this code that have what are often referred to as hard limits, also known as trade-off limits. These are basically prescriptive requirements. In other words, they're requirements that you can trade down, but they can only be traded so far. We'll talk about those in detail when we come to them.

The major categories that are covered in this code, the building envelope that is the focus, that's where we'll spend most of our time today. That's what most people think of when they think of the requirements of an energy code. There are some limited requirements on HVAC and systems and I say "limited" because the federal law pre-emptively regulates equipment efficiency itself, so it's only the systems and related machinery that this code impacts. Lighting, as I

mentioned earlier, is a brand new requirement in 2009. The requirement is fairly simple. We'll talk about it more later but basically 50% of the lamps in permanent fixtures must be high efficacy. A high efficacy lamp would be something like a compact fluorescent bulb. Note that this is based on a simple count of the bulbs, not the fixtures or the watts or anything like that. It's a count of bulbs, so one fixture with a large number of lamps in it can have a big influence on the fraction of lighting that's high or not high efficacy. There are a few other systems outside the home itself that are covered by this code, pools, snow melt systems and so forth. I note appliances simply to make the point that there are no requirements for any appliances beyond the ones that have been mentioned in here. The one thing that you might think of is water heating, and that's included under the HVAC and systems category.

Compliance path, if you read - - if you're reading the IECC for the first time, you might have a hard time figuring out what the compliance paths are. They're not straightforward in the code itself. So I'll talk first, very literally what the code says, and then I'll give you a slide here in a second that gives the more practical understanding of what those compliance paths are. As I mentioned earlier, there are some requirements that are labeled as mandatory. Those must be met regardless of which compliance path you take. Then you have a choice in the code, either a performance approach where you do an energy calculation to show your compliance or a prescriptive approach. Then under the language in the IECC, the prescriptive approach has three alternatives. You can either choose to do an R-value computation, which is a misnomer by the way because there are no computations required when you do an R-value compliance or a U-factor alternative or a total UA alternative. All three of those as far as the text of the code is concerned are prescriptive approaches. It's important to note that if

you use the R-value computation, there are no trade-offs at all permitted. You take what's in the table. The U-factor alternative is very similar to the R-value prescriptive computation. No trade-offs allowed; it simply bases the component requirements on their U-factors rather than R-values. So it's essentially equivalent. The total UA alternative uses the same U-factor tables as the previous one, but it does allow you to make trade-offs across building elements. In other words, you can trade better walls for worse ceilings or something like that. As long as the building element involved is characterized by a U-factor rather than, for example, a Solar Heat Gain Coefficient or anything else. The performance path, the full performance path allows all trade-offs, although as I noted earlier, as of the 2009 IECC, it is not permitted to trade down any envelope measures in trade for better HVAC efficiency. So that's the literal way the code interprets its own compliance paths. In a more practical sense, there are either two or three approaches to compliance, depending on how you look at it. There's the prescriptive R-value approach over on the left looking at it in terms of three paths. Then there's a UA path in the middle where you can do simple trade-offs based on UAs and then a simulated performance path on the far right that involves software. Note that the prescriptive, what I've called prescriptive, the R-value, uses one table. The other two paths use the U-factor table, so you're either - - you're working from one of two tables via one of three practical paths. Once you get your head around that, it's not so complicated.

We keep talking about the R-value path and, in fact, this is probably the best known table in the entire code, so I'll show it to you here in overview. Notice along the left-hand side that there are seven unique climate zones, as I mentioned earlier. The moisture regimes are largely absent from the definition of the residential climate zones. The one exception being that the climate Zone 4

marine portions are lumped in with climate Zone 5 for residential purposes here and Zone 7 and 8 are combined into one zone, so there are seven rows in the table. Each column then is a component of the building and, for the most part, those components are labeled in terms of R-value. We'll talk about those in detail. You'll also notice there are a lot of footnotes at the bottom of this table, a lot of further restrictions, allowances, exemptions and so forth that are explained down there. We will talk about many of those as we go through this. I've already - - it's worthy to note that there are more than R-values in the R-value Solar Heat Gain Coefficients but predominantly the insulation requirements in this table are expressed in terms of R-value, and that's why it's typically referred to as the R-Value Table. The U-factor and total UA alternatives, the U-factor alternative itself is very similar to the prescriptive R-Value Table, but it uses U-factors to characterize those components rather than R-values. This simply allows you to make use of less common construction techniques such as insulated - - structural insulated panels or perhaps advance framing whereby you get a better R-value for - - or I'm sorry, a better U-factor out of a lower R-value and so the code would allow you to do that. But the U-factor alternative itself allows no trade-offs between building components. The total UA alternative uses the same U-factor table, but it does allow trade-offs across U-factor based components, and this is the primary alternative. For example, if you're familiar with REScheck software, that's used in that software.

Here's a picture of the U-Factor Table, very, very similar to the R-Value Table. The only difference being it's expressed in terms of U-factors rather than R-values. With regard to compliance tools, what kind of a tool is required to demonstrate compliance, with regard to prescriptive and by that, I mean the R-value approach, there's really no tool needed. The table says R-30; you put in R-

30 and you're done. The total UA alternative can be done with hand calculations, although very few people will want to do that. Typically, you're going to use some software such as the Department of Energy's REScheck software or something else that's put out by a private company. On the energy performance pass, the energy analysis that's required, requires - - the code itself requires that software be used, and it has some minimal requirements of that software. You're going to be using something like DOE-2 or Energy Plus or one of the proprietary-type tools such as REM/Design, Energy Gauge, and there are others, so those are the tools that would be involved for these various compliance paths.

Let's jump into the details of the requirements. We will start by talking about the building envelope itself and the prescriptive requirements related to that, and we will tend to focus on the R-Value Table to describe what the code requires as we go through this; but always bear in mind that you could also comply via a U-factor for the component we're talking about or you could trade that component against improvements elsewhere if you wanted to lower the R-value.

Start with ceilings - - you can see the column here in the R-Value Table, fairly straightforward, requirements for R-30 in Zones 1 through 3, 38 in 4 and 5, and 49 in the northern zones. It's not quite as simple as it appears there because there are many helpful exemptions and allowances regarding ceilings to make it easy to comply without having to depart from the simple R-Value Table. With regard to ceilings underneath attics, the R-Value Table assumes that you're using a standard truss system. That standard truss system tends to put the top cord of the truss, the rafter, if you will, right down to the top plate of the wall, so that you have a restriction in that corner where you can't get the full thickness of the insulation. When the code, for example, requires an R-38, it is assuming that

you won't have a full R-38 out there near the east because it's constricted. There are several problems with that. You get those cold corners where they're not very well insulated. That can contribute to condensation up there in the attic, which brings with it mold growth and rot and other problems. It can also contribute to the possibility of ice dam formation. As heat from the house melts snow on the roof right there at the corner, that melted snow runs down onto the eave where it refreezes and builds up a dam that can push water back underneath the shingles. So because of those issues, the R-value prescriptive path encourages the use of raised heel trusses whereby the top cord does not come right down to the top of the wall plate but is raised up a bit so that you can get the full thickness of insulation all the way out to the wall. That eliminates those cold spots and the problems that go with it. If you use that kind of an energy truss, as it's called sometimes, you're permitted to lower the R-value requirements in some of the zones. Anywhere where the prescriptive requirement is R-38, you're permitted to use R-30 if you have a raised heel truss that gives you full thickness all the way out over the wall. Similarly, if the R-Value Table has a requirement of R-49, you can comply with R-38 if you have a full truss out there. Do be aware that this allowance applies only to the R-value prescriptive pass not the U-Factor Table. The U-Factor Table accounts for that automatically because the U-factor will account for the lack of insulation in those corners of the attic.

Ceilings without attics, this would be your typical vaulted ceiling or cathedral ceiling. There are some helpful allowances here again to make it easy to comply with the R-Value Table without having to go to the U-factor or UA alternative, and basically if the vaulted ceiling has a requirement from the table that exceeds R-30 but the rafters or trusses that are involved there are not large enough to accommodate that higher R-value, then you can comply with not more than R-30

for up to 500 square feet or 20% of the total insulated ceiling area, whichever is less. So, for example, if you have a small vaulted ceiling over the entryway and because it's small it has relatively small framing members up above and you're in a northern climate where R-38 is required, the code will allow you to put R-30 in instead. In other words, it will not require you to redesign the structure of the building putting in larger framing members just to accommodate the R-38, as long as the area again is less than 500 square feet or 20% of the ceiling area.

Finally, there are some requirements related to access hatches into the attic. This actually applies to access hatches and doors between any condition and unconditioned spaces; but for the most part, this is doors and hatches into the attic or perhaps into a crawl space. There's a requirement to insulate those doors and, in particular, you have to insulate it to the same level as the surrounding element that it's in. So if you have an access hatch into an attic with R-38, the access hatch itself has to be insulated to R-38 with appropriate provisions, for example, a baffle or a wall retainer to hold loose fill insulation away from that opening when it's opened. There's also a requirement that you give access to any equipment that's up there without the repair person having to step on the insulation. You can't just blow insulation all around the air handler. You must build a platform up to the air handler that's over the insulation, for example.

Moving onto above-grade walls, above-grade walls include both standard walls between the condition space and the outdoors. Walls such as knee walls that have perhaps an attic space on the other side or perhaps a crawl space on the other side, and it also includes the areas around the rim joists, which likewise have to be insulated to the same level as the walls themselves. Looking at the column, you'll notice it's labeled "Wood Frame Wall R-Value". There are some

special requirements and allowances for different types of walls, whether they be concrete, masonry, log walls, steel frame, and we'll talk about those as we go. Notice that R-13 is a requirement through Zone 4. Zones 5 and 6 have an R-20 or 13 plus 5. Now it's important to understand with regard to the wall requirements, any combination of insulation within the wall cavity or in terms of a sheathing insulation on the outside, which we would call continuous, it's not broken up by framing members, will meet the requirement. So the R-13 requirement could be met with an R-10 in the wall cavity, plus an R-3 sheathing on the outside or R13 completely in the cavity or, if you wanted to, R-13 sheathing with no cavity, any combination will work. There is one exception in Zones 4 and 5. The R-20 requirement can be met by a combination of R-13 cavity insulation plus an R-5 insulating sheathing. To talk about some of the special cases, what the table calls a mass wall, that would be concrete, concrete block, solid log walls, anything with sufficient mass that it's able to store a significant amount of heat within the wall itself. There are special requirements for those that acknowledge the fact that that storage ability of the wall can improve the performance of that wall in terms of energy, especially in southern locations for cooling purposes. Now the two numbers you see in that column, the 3 / 4 in Zone 1, the second number, the higher number applies when more than half of the R-value is going to be on the inside of the wall mass. What that means is the thermally massive walls lose a lot of their advantage when you insulate the building from them. So it's much better from an energy standpoint to have the insulation on the outside of a thermally massive wall than it is to have it on the inside. So if you have most of the insulation on the inside, you have to have a little bit more of it. With regard to steel frame walls, there's a separate table. There's no column in the R-value table related to it. You'll notice there are several categories in this table for ceilings and walls and floors, but the important

point to understand this table is it's all based on the wood frame R-value requirement from the previous table, from the R-value table. So the very top example in there for a steel truss ceiling, if the zone you're in has a requirement of R-30 for a wood frame ceiling, then for a steel truss ceiling, you would be required to use R-38 or R-30 in the cavity plus at least an R-3 continuous that covers the framing members or R-26 plus 5 that covers the framing members and so forth. So it's based on finding an equivalent system that will perform equivalently to the wood frame requirement that's in the R-value table. As I mentioned when it says R-26 plus 5, that means the first number is - - can be a cavity and it means you must have at least the second number, R-5, that covers the framing itself and is continuous along the ceiling or wall or whatever. There is an exception in the southern climate zones. You can reduce that second number, that continuous number down to R-3 regardless of what it is in the table. If you're using walls that are on 24-inch centers, meaning you have less of the wall area taken up by the steel framing. In ceilings, insulation that exceeds the height of the framing is required to cover the framing. You can't just put a bat stacked up high with gaps in between it over the framing members. You must cover the framing members if the thickness would allow it.

Fenestration, there are three columns in this table related to fenestration. They are not R-value requirements. They're U-factors and Solar Heat Gain Coefficients, and it's important to understand what the columns mean. In general, in the IECC, the definition of fenestration includes all windows, all glazing, all doors, whether opaque or not. But with regard to this table, skylights, for example, which would normally be considered part of the fenestration in the building, have a separate requirement, so you would use the skylight column rather than the fenestration column for any skylight requirements. Similarly, the

third column that says “glazed fenestration,” which relates to the Solar Heat Gain Coefficient, that includes all glazed fenestration, both skylights and vertical and any glazing with indoors but, of course, it would not apply to opaque doors. The Solar Heat Gain Coefficient requirements are limited to climate Zones 1 through 3, which are the southern portions of the U.S. It’s important to note that both the fenestration U-factor and Solar Heat Gain requirements, and this would be true of all fenestration including skylights, the requirements themselves are based on area weighted averages. What that means is if the requirement, for example, is .5, you could either have all your windows to be 0.5 or you could have half of them 0.6, half of them 0.4, and they would average out to 0.5 and that would comply as well. It’s all based on an area weighted average as defined in the equation there. Multiply each window’s U-factor by its particular area, sum up all those products, divide by the total glazing area, and you get the area weighted average U-factor, which is what’s being regulated in the code. There is a requirement that products be rated by NFRC, the National Fenestration Rating Council and certified according to their rules. There are some exceptions just based on the nature of the default, U-factors for unrated products. Any single pane product will comply in Zone 1 and any double pane product that has a thermally improved frame like aluminum with a thermal break will comply in Zone 2. They’re similar to some of the allowances in ceilings in the R-Value Table. There are some exemptions with regard to fenestration to make it easy to comply through the R-Value Table without having to go to one of the more complicated compliance paths. There is an exemption of up to 15 square feet of glazing per dwelling unit, completely at the builder’s option. This would, for example, allow you to have a decorative sidelight around the front door or a glazing unit, some sort of a decorative thing that you bought at an art show to use as a small window in the hallway, anything like that that’s not going to have a rated value. If

it's less than 15 square feet, you can just ignore it, pretend that it's not there and not worry about it in the code compliance process. There's also an exemption if needed of one side hinged opaque door assembly, up to 24 square feet, again to accommodate some sort of a decorative door or unusual door, you can just leave that out of compliance altogether.

One final comment, any replacement fenestration that includes both glazing and sash must be brought up to code. I mentioned earlier that if you replace only the glass, you're not required to bring it up to code; but if you replace glass and the sash, you must. Trade-off limits, fenestration both U-factor and Solar Heat Gain Coefficient are subject to trade-off limits. They are prescriptive requirements which means typically they can be traded off against other building elements, but there are limits to how far you can trade them. The table here shows the absolute maximum U-factor allowed in climate Zones 4 and 5 is 0.48. Zones 6 through 8 is 0.4. Now the prescriptive requirement for those zones is 0.35. If you wanted to have it higher than 0.35, you're going to have to beef up another part of the building regardless, but regardless of how much you improve the walls and the ceiling and the floor, you cannot have a U-factor that's worse than 0.48 in Zones 4 and 5. The hard limit for skylights is 0.75 in Zones 4 through 8. Once again, the trade-off limits are based on area weighted averages of all the glazing in the building, all the fenestration in the building, I should say, so you can have individual glazing units that exceed this U-factor maximum of 0.48, as long as the average in the building does not. Solar Heat Gain Coefficient very similar. Zones 1 through 3 typically or prescriptively have a 0.3 requirement, a maximum allowable Solar Heating Coefficient of 0.3. You can trade that up to a 0.5 through the performance path but not beyond 0.5. Again, that's an area weighted average as well.

Moving onto floors over unconditioned space, it's labeled in the R-Value Table simply as floor. The numbers are fairly straightforward, and here there's typically not a continuous R-value listed for a floor R-value but you would simply sum any cavity plus continuous to get this number if you did have such a thing. There is one exception to accommodate floor framing through the R-Value Table. If the framing members are too small to accommodate R-30, for example, insulation that fills the framing cavity is deemed to comply as long as it is not less than R-19. So in those two zones, that would be - - it's off the edge of the slide here but Zones 4 and 5, I guess, that have an R-30 requirement, if your floor framing members are not large enough to accommodate that, you are permitted to use R-19 as long as that fills the cavity.

Floors over unconditioned space, note that the definition of unconditioned space would include outdoor air. It would include an unconditioned crawl space, an unheated basement, a garage underneath, anything like that that is not directly conditioned. One final requirement, the insulation in the floor framing members, if it does not completely fill the cavity, the gap cannot be against the underside of the sub-floor. The insulation must be pushed up to be in substantial contact with the sub-floor and held up by one means or another. That's to prevent airflow up above the insulation, which could short circuit its insulating ability.

Moving onto foundations, in particular, below grade walls as they're defined in the code, typically they're called basement walls and, in fact, that's how they're labeled in the table here itself. Once again, the column has more than one number. When there is a requirement, there are two numbers. The 5 / 13, the 5 refers to the requirement if it's continuous insulation, which would typically be a

foam board of some sort that's usually mounted on the outside of the foundation wall against the dirt. The 13 would refer to cavity insulation if you have furred in and finished the inside of the basement wall and put insulation between framing members. You're not required to have both of those. That's an either or. There are some specific allowances. The R-15 cavity - - I'm sorry, 15 continuous or 19 cavity requirement can be met by a combination of 13 cavity plus 5 continuous on the outside. I mentioned earlier that the only place in the code where the warm, humid county definition comes into play is with regard to the Zone 3 basement wall requirements, which is an R-5 continuous or R-13 cavity. That is not required in the counties defined as warm, humid according to ASHRAE's definition. Note that the definition of a below-grade wall in the IECC is any wall that is more than 50% below grade. We'll talk more about that here in a second. If the wall itself is more than halfway above grade, it's going to be required to meet the R-value requirements for an above-grade wall. The insulation depth, it must go down all the way to the basement floor or 10 feet below grade, whichever is less. Now talking about that definition of 50% below grade, here's a quick illustration of a typical walkout basement. The back wall in that basement, which is clearly completely below grade is obviously a basement wall and would be subject to the basement wall requirements. The front wall, which is clearly all above grade would have to meet the requirements for an above-grade exterior wall frame or if it's a masonry wall, the mask wall column. The two side walls are a little bit ambiguous. It depends on what fraction of those walls is above-grade or below-grade as to whether the entire wall is categorized as a basement wall or an above-grade wall. So it's probably to your advantage to be sure that the plans themselves specify where the backfill is going to go and how much of that wall is going to be buried because if you assume that most of it will be buried and build it with the basement wall R-value requirements, but the dirt contractor doesn't

backfill all the way and three-quarters of the wall ends up being above-grade, you may not end up complying with the energy code because you wouldn't be meeting the appropriate wall requirements.

Slab edge insulation, it's defined in the R-value table with two numbers again, the first one being the R-value of the insulation required, the second being the depth to which it must extend. The southern zones, typically 1 through 3, have no requirement for R-value at all. The next two zones only need two-foot depth but an R-10, the northern zones and R-4. Important to understand and this is in a footnote in the table, there is an additional R-5 required if you have a heated slab. So where the requirement is now R-0, it would become R-5. Where it's now R-10, it would become R-15 in a heated slab. The definition of a slab edge application is to a floor surface that's not more than 12 inches below grade. If you've got your slab any deeper than that, you're dealing with a shallow basement and those other requirements would come into play. When the code says two foot depth or four foot depth, that can be any combination of vertical or horizontal extension of the insulation. You can see here three examples of insulating down, let's just - - that looks like maybe two foot depth. It's two foot depth either inside the stem wall or outside or it can extend inward under the slab. What's not shown here, it could also extend outward under the dirt as long as there's at least ten inches of soil over it for protection. If you look at that middle figure, you'll notice the insulation itself is between the slab and the stem wall, which for some people, makes it problematic, difficult to attach flooring and such on the inside of the home, so there is an allowance in that case to cut the insulation at a 45-degree angle so that the concrete of the slab extends closer to the stem wall. There's also an allowance in the code for any location where the

code official deems the termite infestation to be very heavy. You're completely exempted from the requirement of slab edge insulation.

Crawlspace wall insulation, this is different from insulation over the crawlspace but if you have a conditioned crawlspace, as some people call it, there are separate requirements, once again, two numbers. The first one refers to continuous insulation like a board or a blanket. The second refers to insulation between framing members on a furred-end basis of some sort. Obviously, this implies that the crawl space itself is un-vented or as some people would say "conditioned". There are requirements that the space not have the potential for moisture buildup. The two things that govern that are 1) making sure that there's a minimal amount of airflow through that space and that can be done either with mechanical exhaust or a minimal bit of supply air and finally, the exposed earth underneath must be covered with a Class 1 vapor retarded, such as the plastic that you're familiar with. Just to compare what's going on between a vented and an un-vented crawlspace, the typical vented crawlspace is going to have insulation in the floor over the crawlspace, whereas an un-vented crawlspace will have insulation on the crawlspace walls. The vented crawlspace is probably or possibly required to have a vapor retarder as part of the floor assembly, whereas the un-vented space is going to be required to have a vapor retarder on the ground surface underneath. The vented crawlspace has requirements for ventilation openings around the crawlspace wall, whereas the un-vented crawlspace must be mechanically vented one way or another either with pure exhaust or actually by bringing some conditioned air in. Ducts in the crawlspace because they're in unconditioned space in a vented crawlspace must be insulated to R-6, whereas if you've insulated on the stem wall or on the

crawlspace wall and you have an un-vented space, that is conditioned space and you don't have to insulate any ducts that are down there.

Moving onto HVAC and systems, this covers a number of areas in here. We'll talk about equipment efficiency and some of the related systems and controls. Most of these are what we would call mandatory requirements. Looking at the list here, nearly everything involved is mandatory, which means there are no trade-offs permitted. The only thing you see on this page that is prescriptive is the insulation on the ducts. The only thing that through the performance path you can trade down that R-6 requirement to, I believe, as low as R-4, if you make compensating improvements elsewhere.

HVAC equipment, which is perhaps one of the most important systems related to energy features is really not dealt with directly in the IECC because federal law establishes minimum efficiencies via a DOE rule making and those federal requirements pre-empt any state or local building codes. So the IECC generally just points to the federal minimums as what's required in the home. The multi-family applications, if you have systems that serve multi-dwelling units rather than a separate system for each dwelling unit, you're not subject to the residential chapter of the IECC. You must comply through the relevant chapters of the commercial chapter, relevant sections, I should say, of the commercial chapter, 503 and 504. Ducts, as we've mentioned, must be insulated if they're in unconditioned space. Supply ducts in attics must be insulated to R-8. All other ducts, both supply and return, must be insulated to R-6. It is mandatory that the ducts be sealed in accordance with the IRC joint and seam specifications. You're not permitted to use building framing cavities, for example, as supply ducts; and there is a required test of the air tightness to verify that the ceiling has been done

correctly. This duct tightness test is a new thing in the 2009. It's fairly complicated because - - to look at anyway in the code because it tries to be very flexible but it's really pretty straightforward. The tightness test if required, and you have two major approaches you can take as a builder, choose either one. You can test post-construction when the building has been completed. All the drywall is in and everything is sealed up or you can test immediately after rough-in of the HVAC system with the ductwork, your choice. If you test post-construction, there are specific limits on either leakage to outdoors or total leakage, some of which might be to the indoors. You can choose either one of those to comply with, and there are specifications for how the test is done. If you choose the rough-in test, you can only test total leakage. There's no leakage to outdoors alternative, and the requirements of that test are more stringent because not all of the duct system will be in place. The registers are not sealed against the ceiling drywall and so forth. The one exception to this tightness test is that if the ducts and air handler are completely inside condition space, you don't have to test the tightness. You do still have to seal the ducts, but there's no requirement for a test. There are requirements for a programmable thermostat on any forced air system with specific requirements regarding what temperatures it can maintain and even there are requirements for how the thing must be initially programmed, set point temperature no higher than 70 for heating, for example, no lower than 78 for cooling and so forth.

Moving on, there is a requirement on heat pumps that the supplementary heat, the electric resistance backup can be, must be capable of being locked out when it's not needed except during defrost and so forth. Most of these things are controls that are pretty standard in most buildings, but they are required by the code. Any piping related to the HVAC system for a hydronic distribution system,

for example, is required to be insulated to R-3, the only exceptions being pipes that carry fluids that are not very cold or not very hot. Domestic water heating piping in contrast, if it's a circulating system, is required to be insulated to R-2 rather than R-3. There are some requirements for ventilation in the building, as well as equipment sizing. The ventilation requirements simply say that any outdoor intakes or exhaust have to have a gravity or an automatic damper that will close it when the ventilation system is not operating; however, there is not any requirement for whether those intakes and exhaust be present or how many of them, simply what they have to look like if they are there. The code does require that equipment be sized properly. It makes reference to section 1401.3 of the IRC and requires use of something like the ACCA Manual J to do the calculations and there are limits. The intent is to get the HVAC system sized correctly so that it operates as efficiently as possible.

Moving onto the rest of the code, the other requirements I'm calling them here. A lot of things, some of these more important in the energy picture than others, we'll talk about them roughly in order here. They are roughly more important at the top of the list. With regard to envelope air leakage, there are many, many places where the air can leak in and out of the building. Recessed lighting is one big one. If you have recessed lighting that goes up between the conditioned space and into an attic space, there are some specific requirements related to those, fireplaces or other areas where a lot of leakage can happen if they're not done correctly; but in general, the code does require that all penetrations through the building be caulked or sealed or gasketed in one way or the other, all joints and seams similarly covered and wrapped and so forth. To be sure that the builder has done a thorough job of sealing all those holes, there are two options for the code official. There's - - the builder can either choose to perform a whole-

house pressure test with a blower door system to make sure that the leakage of the envelope is not more than what's expected or there's a fairly thorough checklist in the code that can be field verified by the code official as an alternative. Many, many places in the building that must be dealt with and sealed correctly and in the opinion of many, simply doing the blower door test is the cleaner way to discover whether everything has been done correctly rather than inspecting everything; but the code does require either alternative.

Lighting equipment, brand new one in the code: There is a requirement that at least 50% of the lamps in permanently fixtured lighting fixtures or permanently installed lighting fixtures be high efficacy. There is a definition of what high efficacy means. As you see down at the bottom of this slide, basically your compact fluorescent bulbs will meet that requirement. Your incandescent ones will not, and there are certainly other technologies out there and on the horizon that will likewise meet these high efficacy requirements, but that's the common example. Note the 50% limit is on account of lamps not fixtures. That can be confusing to some but you're counting lamps. If there's two lamps in the fixture, you count two. Recessed lighting fixtures are required to be rated for insulation contact when they are up in insulation. There's a requirement that they be sealed with a gasket where they touch the, for example, the drywall in the ceiling or whatever covering is there to limit infiltration through that opening.

With regard to additions, we talked a little bit about this earlier. It's very easy in the 2009 code to treat them as a stand alone building or portion of the building, in other words, to ignore the rest of the building and simply make the new space comply. The prescriptive requirements are designed such that that's easy to do because there are no considerations of glazing percentages and so forth, which

tend to get or can tend to be very large when you're looking at a single room. The code has some relaxed, if you will, requirements for some of the exterior surfaces of sunrooms provided certain things are true. Now the definition of a sunroom is a single-story structure with glazing area exceeding 40% of that one room or one-story structure's gross wall plus roof area. It must have a separate heating or cooling system or be zoned as a separate zone, and it must be thermally isolated. In other words, it's going to need to have closeable doors or windows between it and the rest of the house. If those things are true, then there are a few relaxed requirements for various parts of that sunroom. I won't go into detail there.

There are some requirements for snow melt systems. If you have a snow melt system on the driveway, there is a requirement for an automatic shutoff when the pavement temperature exceeds 50 degrees Fahrenheit and there's no precipitation falling. There's also a requirement for a manual shutoff when the outdoor temperature itself exceeds 40 degrees. There's requirements for pool heaters. They must have accessible on/off switches and you cannot have a pilot light, a continuously burning pilot light on any gas-fired pool heater. Requirements for time switches to deal with those heaters and pumps as long as other health standards don't apply or you're not using solar systems to heat the pool. Then there's a requirement for a pool cover to be left with the pool at the time of construction. If the pool's going to be heated to anything in excess of 90 degrees Fahrenheit, there must be a vapor retardant pool cover. Limiting the evaporation of water is very important in terms of avoiding energy loss. You're excepted from that as long as the pool is heated at least 60% by a solar or site recovered energy source.

Fireplaces must have gasketed doors and must take their combustion air from outdoors. Okay, we're winding down near the end. We'll back up now and look what's placed generally toward the beginning of the code book in the first few chapters, the compliance options, the administrative requirements. We've alluded to the simulated performance alternative a little bit. We won't talk about it much here today, but it does require software. You're basically having to model with the software to two buildings, one building that exactly meets the prescriptive requirements and a second building that's designed, according to your proposed home as long as your proposed house uses less energy or energy cost, depending on your jurisdiction, than the prescriptive home, you comply. Section 405 of the code sets up the ground rules for how you do those energy comparisons. Most of those ground rules will be hidden in the software tool that you use. It's not at all un-similar to the kinds of rules that you may be familiar with through home energy rating systems, federal tax credits, Energy Star Homes, and so forth. So that's all we'll say with regard to the simulated performance alternative. Usually you have the software that is going to take care of most of that, most of those details for you. There is a requirement in the code that you leave with the home a certificate that explains the major energy features of the home. It has to be posted, permanently posted in or on the electrical distribution panel where the occupant, ultimate occupant can find it. Of course, you can't cover any of the required labels related to the panel itself, but it must be there to explain to the homeowner what's in the building, the major equipment - - or I'm sorry, major building elements, what their R-values and U-factors are must be on there. The Solar Heat Gain Coefficient of the fenestration, HVAC efficiencies, and so forth must be listed there. If, as one odd example - - To say it's odd, it may strike you as odd, there is one requirement that if you have a, for example, a baseboard electric heater, you're not permitted to say that that's a 100% efficient

system. You have to simply explain what it is, a baseboard electric heater. The reason for that is it can be confusing to see a home with a very nice condensing furnace that only has a 91% efficiency and the building next door that has expenses to operate an electric heater has 100% showing; that can be confusing to an occupant who doesn't understand the difference. So there are specific requirements for labeling the type of equipment when it's an electric system, for example. Various compliance and documentation and inspection boilerplate, most of you, if you have worked with building codes at all, will be familiar with most of this. The local official, as always, is the final authority in all matters. The code makes explicit allowance for electronic media to be used to turn in the documentation for code compliance and so forth. The code official is permitted to demand a permit for any work that's going to be done and to conduct an inspection when that's done, and we just mentioned of course the certificate that's required. Mostly boiler plate here, I won't go into detail on it but I believe we have covered the entire 2009 code and a bit of a break next speed. There is going to be time now for questions and answers. Many of you have been sending in your questions, and we will address those next.

Rosemarie Bartlett: Well, thanks, Todd, and thanks to all of you. The U.S. Department of Energy appreciates your attendance today. Before we begin answering as many of the questions that have come in as possible, I'm going to put a link up on the screen. You need to write down this link very carefully and type it into your browser if you are an AIA member and want credit for attending the broadcast today or if instead you want to generate and print a certificate for self-reporting to a different professional organization. Please note that the link does have a hyphen in it, so please do write it down carefully. Some questions that have come in related to the video of this broadcast in answers to the questions, so I just wanted to let you

all know that a video and a transcript of the event will be posted at: www.energycodes.gov within the next two weeks. We also had a few questions related to the availability of REScheck with the 2009 IECC in it. That's currently being tested, and we plan to have a release of that in early July. With that, I'm going to turn it over to Todd.

Todd Taylor: Thanks, Rose. Thank you, Rose. We will move through these as quickly as we can and try to get as many in as possible. We had a limited bit of time left, so I don't know how many we'll hit but we'll do our best. A couple of people have asked: what happens when a building is being built in a portion of the county that is different, if you will, in climate from the rest of the county? For example, one example gives Bernalillo County in New Mexico as being very different from the remainder of the county; probably that's a mountainous region. Basically, the code was designed with county level assignments, so that within a jurisdiction, the requirements are always homogenous, always the same. That works in most of the U.S., but there are some places where there are some drastic climatic differences from one part of the county to another. The county assignments that are in the code were based on sort of a population weighted average of heating degree days and such to hit the majority of buildings with the assignment. The reality is there are some locations in some counties that just don't fit well to that population weighted assignment. All I can say here, the code is what it is but there is nothing that prevents a builder from building a home better in the colder climate, in other words, adding additional insulation; but in order to get those higher levels of insulation required in those locations would require a modification of the code by the local adopting authority. The code itself does not require anything more of those colder spots in the climate. I also had a couple of requests for a cleaner picture of the climate zone map because all of my notes

were slapped right across the top of it. As Rose mentioned, there will be a video of this posted. There will also be a link posted then to a clean copy of the figures so you can download it yourself without all the notes on top of it.

Someone asks if an at-home office would be considered commercial or residential. Most likely, if it's just a desk and a computer in an extra bedroom or in the den or whatever, when the building's under construction, that's going to be residential and no one is ever going to know that it was intended to be an office. If the at-home office is itself a separate room or a separate building that's added on in addition, if there's anyway for the local official to know at the time of construction that it's being intended - - that's its intended use is as an office, then it would be up to that local official to recognize that as a commercial occupancy, and he might require that it be complied under Chapter 5. I dare say most home offices at construction time, no one would know that it's going to be an office.

Question: Do the repairs to existing homes apply to work done by a commercial contractor and the homeowner? In other words, if the homeowner does the work himself, does the code not apply? Well, the scope of the code applies regardless of who does the work, so if the homeowner is planning to do the work, there is still a requirement to pull a permit and abide by the requirements of the code, assuming the code is in place in that jurisdiction.

Next question and this is an interesting question because it asks why and theoretically, I can't answer a question that asks why but the question is: Why is HVAC not allowed for trade-off value consideration? As we mentioned, the performance path in the 2009 for the first time has eliminated the allowance for trading higher equipment efficiency for lower envelope efficiency. I can't tell you

why but I can suggest because this is a very - - I know this is a very important point. Based on the testimony that went on at the code hearings and so forth, some of the major considerations for that decision were the inability of the IECC to regulate the HVAC equipment itself because the AFUE and HSPF and SEER numbers and so forth are pre-emptively regulated elsewhere by federal law, the I-codes can't influence those and so it was deemed inappropriate for I-codes to give credit for improvements over those. Basically, based on the observation that common practice these days has exceeded for many of these equipment types the federal minimums that are still in place, so those were the testimonies, those were the arguments that were made at the hearings. You would have to ask the individual voters why they chose to go that way.

Here's a good one to point. I think this came in several times. The R-value in the code, they say, is referring to a laboratory test of conduction heat transfer only. So the question is: What about the performance of spray foams when compared to the performance or lack of performance for a higher rated R-value fiberglass system? These are arguments that come up occasionally. As far as the code is concerned, an R-value is an R-value. There is no difference between one type of insulation and another. The only thing that matters is the rated R-value and that is the stand of the code at this time. There is a question about the new requirement for duct pressure testing. The question is: Is there not an inspection option for the duct pressure testing on the whole building air sealing question, you do have an option. You can either go the inspection checklist or do a pressure test. That is not the case for ducts. Ducts must be pressure tested unless they are entirely, including the air handler, inside the conditioned space.

A question regarding the energy performance compliance option, and we had a couple of questions about the Trane Trace software and whether that's an acceptable software tool for the energy analysis. It's - - possibly it is. I'm not that personally familiar with Trane Trace. There are some requirements laid out in the code for any tool that's used to demonstrate compliance through the performance path. Some of those requirements are, for example, the tool must generate automatically the standard reference design, in other words, the minimum code home against which your design is going to be compared. It has to be auto-generated by the software. I don't know if Trane Trace does that but that's one of the requirements of any tool that is used for this. The software must do whole building based sizing of the HVAC equipment. There's a requirement that it print out a checklist to aid the code official in checking compliance and then there are some requirements that particular analysis capabilities be present in the software. That said, there's also a clause in the code that allows the local official to permit the use of other software that might not meet all of those points if that software has been designed for a specific application or for a limited scope that only addressed a minimum number or a small number of possible changes and so forth. So as with so many things, the final answer is you have to check with the local official; but in general, the software must meet the list of requirements in the code.

Another question related to the performance path, at least in the answer: Do any of the compliance paths recognize or capture the benefit of using reflective roofing or radiant barrier sheathing to reduce Solar Heat Gain of roof (inaudible) in cooling climates. The answer is "yes". You can account for those things via the performance path. The performance path will allow you to enter the specific absorptivity and emittance values for the roof in question and the software is

required to compare that against the baseline level; and if yours are better than the baseline, then you can get credit for that through the performance path.

There were a few questions that they kind of relate to things going on outside the code related to the potential for new legislation and that sort of thing. I am not going to speculate on new legislation, but I will address one particular comment or question that came in. It says, "The administration," talking about the Department of Energy, I'm sure, "is on record as wanting all windows nationwide to be a 0.3 Solar Heat Gain Coefficient and 0.3 U-factor". I'm not certain what that's referring to but I will say and the question is: Is this being reconsidered in light of the 2009 IECC? The IECC is not under the Department of Energy's control. The IECC is developed by the International Code Council. They have their own process. It's a very open, participatory process and the Department of Energy participates in that and may offer testimony from time to time, but I just want to make the point that this is not the DOE's code. This is the IECC's code.

Big question: Have any states adopted the 2009 IECC? The answer to that is basically yes. There are a number that have adopted or are in the process of adopting this code, and it will become effect in the near future, some of them later this year. I'll just list a few: Maryland, Maine, New Hampshire, Rhode Island, West Virginia; Illinois is in the middle of the process, I think lacking only the governor's signature. There's a handful of other states that could adopt it in the next month or so based on what's going on in process at the moment. I won't mention those because they're not quite certain yet but, yes, there is a lot of activity going on around this code.

Some questions about the specific R-values. The code requires an R-38 in an attic - - if the code requires an R-38 in an attic, and I have a raised heel truss, am I correct in understanding that I can use R-30 in the entire attic or is it just for the ends near the eaves? The answer is: If you have put in an energy truss, a raised heel truss such that the ceiling insulation can be full thickness end-to-end, from wall-to-wall, then you can use the lower allowance, the R-30 allowance, in the entire attic. That's the gist of that allowance. If the insulation is going to be restricted in the eaves, you have to use the full R-38 from the R-Value Table; but if you use the higher truss, you can use R-30 everywhere in that attic system.

Someone else - - well, I think there's another question about that. Oh, here we go. Related to ceilings and vaulted ceilings where there's a truss with potentially limited space to install insulation, the question - - I'll just read the question. On vaulted trusses where the truss will not allow R-38 all the way to plate, you had said that it can be reduced to R-30 in 20% or 500 total square feet. The question is: Does that mean the lower edge of the truss near the plate should be R-30 and then the remainder of the ceiling should use R-38. The answer to that is only if that's necessary to keep the R-30 part less than 500 square feet or 20% of the total. In other words, the allowance is there to make it easy to use the R-value prescriptive path even when you have a small section of the home that has a vaulted ceiling that couldn't accommodate the full R-38. You can get by with R-30 in up to 500 square feet of the vaulted ceiling space anywhere but only up to the 500 square feet or 20% of the total, whichever is less. That relates to yet another question on this which asks: If both the 500 square feet and the 20% have to be met and basically it's the - - whichever is smaller. You are given the allowance up to the smaller of 20% of the total ceiling area or 500 square feet.

The lighting, the new lighting provisions elicited a few questions and one person here gives the example of an LED rope fixture, which has a whole lot of small LED lamps within it. The question is: Does each LED in the rope count as a bulb; and if so, it seems like this would very much screw up the number of efficient fixtures. All I can answer to that is given the example put forward, that's probably, by the letter of the law, that's probably correct. Bear in mind that the limitation, the 50% of lamp's limitations applies only to lamps in permanently installed fixtures, so that LED rope would have to be permanently installed not plugged into an outlet. I would also point out that the same issue cuts both ways. For example, one large chandelier in the entryway can have a huge number of incandescent lamps in it. That could make it very hard to meet the code as well, so yes, if you want to - - if you're trying to beat this part of the code, you can probably play those games; but it's probably easier to just put in some CFLs, if I were a builder. That's the way I think I would go.

Mass walls, someone brings a question about ICFs or insulated concrete forms, saying an ICF has equal insulating value on both sides of the wall. Do we use the first number or the second number for compliance? Well, the answer is: You use the sum of the two. In the R-value table of the IECC with only limited exceptions that I talked about in the presentation and you'll find in the footnotes. When an R-value is written there, it refers to the total R, whether that is in a cavity, whether it's continuous in sheathing or any combination of those two, any R value from inside to outside counts, R-value of insulation only for the R-value table.

May you use R-30 in an attic space with R-38 used for the last two feet where a raised heel truss is not available? The answer is no. If you're not using the raised heel truss, you must insulate to the requirement from the table.

Rosemarie Bartlett: Todd, you probably have time for another question.

Todd Taylor: One more question, okay. I'll ask this one: If HVAC is not considered anymore for trade-offs, then what other elements are used other than other R-values? In other words, what's the point of going to the performance path if you can't do an HVAC trade-off? Well, the performance path still allows trade-offs, so virtually any other element in the building. R-values were mentioned and certainly you can trade the R-values off there. You can trade Solar Heat Gain Coefficients. You can trade, as was mentioned earlier, roof color and those sorts of things. Orientation can be considered. Improvements in the leakage rate of the building over and above what is required in the prescriptive portion of the code. You can account for the effects of building mass as in passive solar designs and so forth. So virtually anything you can imagine that relates to the energy behavior of the building, except the efficiency of HVAC equipment can be accounted for through the performance path. With that, I will turn it back over to Rose.

Rosemarie Bartlett: Well, thanks very much again, Todd, for such a great Webcast and thanks to all of you for participating in today's Webcast brought to you by the U.S. Department of Energy. You may all disconnect.

*Please Note: * Proper names/organizations spelling not verified.*
[sic] Verbatim, might need confirmation.
- - Indicates hesitation, faltering speech, or stammering.