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Building Energy Codes Program

Experiences From the Field
Mark LaLiberte, LaLiberte Online Inc.
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Presentation Video Transcript

MARK: I am going to cover quite a bit of information here today. One of my favorite things to do, and it is because you are such a brilliant group. I am going to come up with about ten pounds of information into a five pound bucket and I am going to go very quickly because you guys are remarkable and your knowledge base of the fundamentals, as well as the more complex issues of building. Bruce did an exceptional job, of course in putting together the ideas of the levels of concern and complexity that we have and something that seems as simple as duct work and distribution. I loved what he said, "What is the tolerance for leaks in plumbing?" I thought that was a great thing. Nice job, Bruce. I think if you think about it, what is the tolerance for leaks and plumbing, and what is the tolerance for ducts? And we are like, "Well, it is just, it is okay." And it is not okay. And so, we are going to talk about some things today and I am going to go through this pretty quickly.

What I intend to cover, I guess, is a little bit about what we see happening and what has happened. Where we have been, where we are going. A little bit about the evolution from failed buildings to doing things properly. And today at the project we were at the co-housing project, there was a lot of things. Everybody got there, did not they? Most people? Taking a look at some of the things that they really tried to do well, showed and demonstrated that you can do it. They can accomplish it and they were doing a fairly nice job of pulling that together.

So, we are going to talk a little bit about what is happening and where we are going. You guys know where we are going in terms of code issues and the vision for the future, a little bit about Building Science and the fundamentals, some _______ design methods, and methods to build better. I took out the HVAC section because Bruce did such a phenomenal job talking about that. I am just going to leave that out of there because you do not need me to talk about that. A little bit about testing and blower doors verification, and just a little bit about how the marketplace is seen, as far as our new client. I am just going to talk about that briefly for a second, though.

Do you think today's consumers, the consumers of houses today, because that is in some ways what some of us represent, is the ability for us to carefully represent the consumer, and perhaps the person that lives in our jurisdiction, or somebody that we are helping to make sure that their house performs well. Is not that kind of our responsibility to them? To have the knowledge base, to implement that, and to know where it needs to be, not just where it is. I think it is important to feel comfortable pushing the envelope a little bit. Is not that okay? Is pushing the envelope a good idea? If you do not, you get to be really comfortable with exactly where you are. And, where we are is where we need to be. There is absolutely a fact in that, right? Buildings are too leaky, ducts are too leaky, energy use is too high, and we have to fix that. We are a little uncomfortable about that over the next 20 years, right? When should we be doing it over? The what? The next year, right? Is it possible? Is it possible? Of course, it is possible. What is the only obstacle we have in terms of moving from where we are to where we need to be? What is the only obstacle? I think that I mentioned it yesterday. NHAB, forget those guys! (Laughter) Even though he is right. What is the greatest obstacle in us moving where we need to be? Attitude. It is attitude. It is choice. We have choice.

The choice is that we are going to make the buildings better, and that is just the way it is going to be. We are just going to do that. We have a country dependent on oil and energies outside our country, domestically, financially, everything that we need to do. From comfort, health, safety, revolves around us building better buildings. So, let us go. Right? Is that the only thing in our way? It is just choice. We have all of these obstacles in our way: not enough guys trained, the equipment, or it is going to be hard. Is there anything that this country has done that really mattered that it was not hard. When you get done with something that is kind of hard, does not it feel amazing? Going, "Well, it was not that bad." Right? Do you ever make things harder than they really are? We all do that. We are extraordinary at that. Is anybody good at procrastinating? I excel at that. I am one of the best on planet Earth at **procrasity**. But, then there is something when you get done, do not you wonder why you procrastinated? You get, you wonder why you did that. I should have just got it done. We are going to move in that direction.

What has changed, I think, is something that is interesting. If you look back, let us say, 30 or 40 years from a materials perspective. Sheeting. OSB has only been around for 25 years, basically. Does anybody remember when it first came out? Yeah, you bought the 760, added water and you get an 1-1/2 inch. Remember that stuff? Yeah. So, this was a problem that the industry said that we have got this cool stuff, just do not let it get wet. Do not ship it to a job site, because then it is going to sit outside and that would probably be bad. Right? Did a lot of people do it anyway? Who fixed the problem? Was it Code that fixed the problem? Lawyers. Industry fixed the problem. Right? Industry fixed it. They said that people are going to go back to plywood if they have to power plane OSB. Have you ever tried to power plane OSB? It does not work that good. So, the idea is to say that sheeting and materials have changed.

We looked at product changes, that evolution and materials have changed our building dynamics. Something as simple as plywood being done for racking strength and some other benefits, mostly speed, changed the ability for the building to breath. Right? You know how many times I teach and work with builders. I talk to almost 10,000 builders a year. So many of them still say that you know, we ought to just build them like we use to. I still hear that. Is not that a good idea? Let us just build them like we use to. I think that would be awesome. Is that going to work? It does not matter anyway, because code is not going to let us, right?

Old buildings that were sheathed leaked rapidly. Energy flowed through. Air flowed through, dried quickly. We looked at thermal insulation. We had thermal insulation in the buildings, that changed the drying capacity capability in the building. That is pretty straight forward. So, we have to move in that direction.

How about cladding changes? Horizontal lapwood siding to cement siding to cultured stone to traditional stucco, through synthetic stucco to all of the other cladding systems. Does a cladding system affect the durability and performance of a building? How many buildings are you seeing an architect send you a plan out and there are three different types of cladding on the same house? The same building? So, if you have three different cladding on the same building and we all agree that they perform differently, is there anything different behind the cladding? Does one need their vented rain screen and the other one not? So, how do you line those up? How do you make those happen? And the changes in cladding are also important.

On the equipment side, we do know that HVAC changed. Now after this last few days, do you think that there is going to be more people adding air conditioning in the Pacific Northwest? They said that in the Pacific Northwest the saturation went from about 25% air conditioning about 15 to 20 years ago to almost 70% . Now, as of tomorrow it will be 100%. You know that nobody is going to put up with this anymore. It is interesting that saturation of air conditioning. In doing that, did that change the dynamics of the buildings once we installed central forced air and moved the air all around and stuck air handlers in garages and stuck air handlers in crawl space, and had the brilliant idea of putting air handlers with the duct work in the attic. Is not that a brilliant idea? Let us put the mechanical system for cooling in the hottest place on the planet Earth. Death Valley is cooler, is it not? On a day like today, if the attic is running 140, what do you think that air conditioner is doing? It is fine. I have like R-6 on the duct. Awesome! I should be fine, right? In the morning when the thing calls for cooling, what is the temperature of the air inside the duct in the attic? It is 110 degrees in the duct and it is below it, so the first thing that happens that before you cool the house, you heat it. Which is a brilliant idea, is it not? So, it is interesting that we have accepted that as an approachable method.

Can we put the ducts in the attic? Well, everybody does it. Every where I travel, the Pacific Northwest, the Southwest; Everybody is putting mechanical systems in attics. And, great big ones, too. In the Southeast, they still do it, are not they? Mechanical systems in the attic is a really bad idea. I would love to say, "No more panning a floor joist and no more mechanical systems in the attic." Who services mechanical systems in the attic? The guy that loses rock, paper, scissors, is it not? It is a day like today and the air conditioner is down. Who is going to go and see how it is doing? There in the truck, (making sounds) "Oh God." So that guy is going to die that day, right? How many of you would work in 140 degree space? I mean, "I'm in, I'm in." Right? Yeah, Bruce would. He needs a little personality improvement, does not he? Was not it funny what he said? He said, "When I have my down time, I start doing research on HVAC." Dude, you totally need a life! They have bikes and things like kayaks and stuff.

Exhaust capacity. Has that gone up? How many of you guys today noticed in the Co-Housing building the size of the fan in the kitchen? Was not that impressive? It said right on it, very fine print. It says, "Be careful, it will suck small animals into this grill on high speed." Right? It is like 3,500 CFM turbo sucker, right? And so, right next to it, did you see the makeup area there? And did you also see that in the common space was the fireplace, with folding glass doors, with quarter inch gaps on the door. I said to the guy, I said, “What is that burning?” He said, “Wood, gas, no problem” I said, “Huh, that ought to be good. Hey, where are you going to get it’s combustion air from to make sure that when the fan comes on, all the pressures are fine?” He said, “You see that little duct out there, the four inch duct that has been smashed from behind the fireplace and running back and forth? Right there. That ought to be fine.” You think? You think that a fully burning fireplace, consuming maybe 200 cubic feet per minute for air is going to be fine just through this little four inch duct that has been smashed on the wall cavity when the fan is running? What do you think the pressure in that house, that building is going to be? Have residential building found commercial cooking equipment in residential buildings? There is a brilliant idea. We required makeup air in commercial building, but residentially it is not that big of a deal. The air is different. (Laughter) So, all of the physics, . . . my whole point here is how the physics always apply the same way. Whether gravity pisses you off or not, it is completely irrelevant. Right? It is the deal. So, then when we argue with it, it seems kind of silly. Be careful of exhaust capacity.

Finally, we have seen a really big challenge with our processing systems. This has become one of greatest nemesis here. In the older days, we talk about framing and reducing waste on the job sites, talk to the old guys that go way, way back; they finish a job site with a couple five gallon pails of waste. They were not trying to get green points, it just made good business sense not to waste. Now the pile has gotten bigger in the places and now we are all concerned about material use, which we should be. How do we get back that process as builds ago? What do you think that big pile of garbage, wood, and by-products are in the front of the yard? They said, “Garbage.” No, actually it is what? Money, of course. It is a great big pile of money. So it is a big pile of money out front. They said, “Well, it really does not matter to me because the trade contractor that is doing the framing bids the jobs, so it really does not effect me. It is in his bid.” Somebody pays for that right? It is not just there is this magic fund that pays for waste and excess, is there? Who paid for that? The owner? But, in reality, it came out of the pocket of the builder who had the potential profit margin to include that. So, it is a process problem. How do we make sure that everybody is on the same page? That is one of the greatest challenges the code creates, right? As we improve the expectations of what we want a building to act like, we have this more and more fragmented subtrade contractor base. Oregon just passed the requirement a while ago, about requiring all trade contractors in the state of Oregon to be traded. All trade contractors; plumbers, electricians, insulation contractors, framing contractors. They all have to be trade on the fundamentals of energy efficiency and durability on building sites. Forty thousand contractors in the state of Oregon. Is not that amazing? How are they going to pay for that? It is irrelevant, is it not? No, it is very relevant. It has to be something that we fund with online training, classroom training, however it gets done, but those trade contractors need training. If we have a process problem as we improve codes, we have to also improve the process. Bruce talked about something and he said that, training. Once you give someone the knowledge to understand the fundamentals of, . . . the box that he had up here, did it make sense? How can you argue with that? You said, “What happens when the gauge says this?” You say, “It is probably not going to be that good.” No, it is not that good. So, is 12% acceptable?

Absolutely, not. Six. Six is where we start as far as duct leakage. Bruce was trying to be really gentle. I gave him a bad time, I said that it is 6%. As I said, we have a complicated business.

So, there is an extensive collection of materials, challenges, building changes and code, communication obstacles. Here in Oregon there is a large concentration of Russian immigrants that are here and a lot of them are in the siding industry. I was on a job site and I was talking to the guy about putting on the rain screen stuff, and I said, "Do you know how to do it this way and this way?" "Yes" I said, "Have you ever put it in this way so that it connects to that piece?" Yes" "How did you get to work today?" "Yes" So, it was okay because he was a phenomenal worker, did a great job, but how am I going to communicate to him what needs to be done when the fundamentals of language are the barrier? How are we going to get that to change? And what are we going to do about that?

Pictorially, I will show you some examples of some opportunities of doing that. We have market expectations and client expectations. So, when someone spends a few 100,000 thousand dollars, a one-third of a million dollars, . . . that is a closet today, 345 to 430, I think was the price I saw on a 3 bedroom. Are there people who have expectations for that building? What are they going to expect it to be? (Someone in audience answers). Yeah, I think so, but it is just a challenge. Now that they have hydronic in floor and no provisions for air conditioning, are they going to have some challenges there? I think so. I think this week could be bad for sells, personally. That is just a personal opinion. What are some of those? Expectations in terms of anybody spending any money for a house today? They want to be, . . . quality, comfortable. Do they expect water intrusion and leaks? When they do, are they pretty frustrated about that? So, their expectations have changed by a couple of reasons. Price drives expectations. But, so does knowledge drive expectations. They say that people are spending between five and six months online before they buy a house or a building to make sure that they understand what it is that they are buying. What are the odds of the trade base and the builders keeping up with the pace of the client, who is looking to buy a house? What are the odds of a client coming in to buy a house, knowing more than the trade contractor or builders? Is it possible? It is probably actually happening as we speak. So, the complexity is really if we look at green buildings there, they try to encompass all of these pieces and we are looking for kind of an optimum vision on substantial ability. So, energy efficiency is important. We know that healthy indoor living is important. The human body respirates about 9,000 liters of air a day. In my respiration cycle, should every house built today have a continuous supply of ventilation for human occupancy, and should it be delivered to all habital rooms? Because, if you dump fresh in one location, how does it get to the children's bedroom with the door closed at night? Have you ever been a teenagers bedroom with the door closed after nine hours of sleep? Boy, that room needs some fresh air! Yeah, I have two boys. You go into those rooms, it is like, "Wow!" That is just human respiration and all of the other stuff going on. Right? So, do we want to supply a fresh air supply to living space, where people eat, sleep, and live? Should we wait for that or do we do that today? Human beings need a continuous supply of fresh air that somewhat matches my respiration cycle. Does it have to be very much? Very small amount of fresh air supplied. Can we get that through leakage? Or can a bedroom be only exfiltration, not infiltration? Understanding building complexity is that we tighten the enclosure ; I believe we need fresh filtered air supplied to people's living conditions and living space. I do not think today's house, with maybe two windows, has adequate levels of ventilation and fresh air, as the enclosure gets tighter. Do any of those spaces smell a little chemically to you? That is a technical term, chemically. Did some of them smell a little bit? Wow! Some of them were so powerful it was amazing. I asked the guy if that was a low view of seal painting. He said that is the finish we put on the floor, it is nasty stuff. That is what we want, more nasty stuff, with operable windows. I think it is a phenomenal concept.

Materials that are beneficial to the environment, that is that green point chasing thing you heard me talk about the other day. When bamboo starts taking a precedent over insulation, I have issues. Bamboo floors do not actually perform that well. Did you look out the window of that one unit, they had planted bamboo. I saw some. There is where it belongs. Just plant it, it is cool.

Durable design. I mentioned this yesterday just a little bit, but in terms of longevity, we all agreed, I think. I am going to make this assumption. Houses should last at least 100 years. I think that is a fair assumption. Can they do that? Can buildings last 50 and 60 years? There is no place else in the world that has been able to accomplish that, right? We are going to push the envelope. We are shooting for 100. Right? When I asked that question, for over 20 years I have asked every group I have spoken to. On the East coast they give me longer time frames than on the Wets coast. Why is that? Are there any houses on the East coast that are older? Yeah, I live in one. It is like 250, okay, but we cannot do that again. That is hard. That is going to be hard. You say that is because we are insulating them up and you are making them too tight. Wait a minute! You think in the year 2009 and beyond we can figure out how to build houses that last for 300 years? What is the only cause of failure in a building? What is the primary cause of building failures? Ninety percent of the time we know what causes buildings to fail, which is what? Mismanagement and moisture; in the vapor state, liquid state. We know that they are attached to soils. We build basements, crawl spaces that are actually excavated pools and heavy wet soils and go, "It is fine." Right?

Looking at our structures, if you build wood frame buildings that are thermally insulated, is that different from a masonry building that has a different performance expectation? Does a CMU building perform differently that wood frame? In terms of durability. In other words, does masonry have the ability to store a little bit of water and then maybe give some of it up after while? Does a wood frame building have less tolerance? Does a steel frame building have even less tolerance? Looking at the way we design a building has to have a direct coronation to our expectations. Would you build a really, really solid, incredibly well built dog house for a dog that is just on his last leg? If you get the pup, you say that you are going to insulate this sucker good, right? Just an interesting variable.

Sustainable sites. Is it possible that we can design communities with an orientation towards understanding in the future we might utilize the sun as an energy source? This is a stretch, I understand. If we did that, would that be possible and are we seeing more people consider that? Do you think, honestly, 20 years from now, we will see a larger concentration of floatable **[tics]** on the fly end of Portland that will actually be roughs? Do you actually think we will see more than that? I think so. I think when you look at the simplicity of design and everything, everybody is waiting for us to come up with a new fuel option that we do not have to deal with, that we can just hydrogen out of the ocean and we are going to be fine. We are all waiting for physics to kind of keep up with us and just go, . . we are almost there. It is like do a few more nukes and we are almost there. I think really amazing insulated, well built buildings is the future, is it not? Are we going to see a substantial increase in our use of electricity? Just as a lifestyle? Yeah. See, our electric consumption, cars maybe in the future are not that far away are going to be running on electricity, as well. We are talking about grid storage of power and everything else. If we look at buildings, they really need to be improved.

Finally, the water efficiency thing. They say that what, I should ask my brilliant new friend over here. They said that about one-half or 1% of the water on the planet is safe to drink. One-half of 1%. Is not that something? So, you do think we should probably be taking better stewards of the use of water? Even in a place like here, should we be doing a better job than that. Everybody thinks that because it rains a lot you do not have to worry about it. It matters everywhere. So, water efficiency is important.

In terms of defining our path and where we are going to go, do you think that it is important that sustainable products are really trying to address all of those pieces in kind of a little more harmonious cycle, and when is it going to take us, and what is it going to drive us? What is going to drive us to do that? I am afraid that we keep giving ourselves too much time. We keep waiting for something. All that is we keep waiting for something to get easier, when to do this is a little harder than what it has been, and that is okay. It is okay to make things a little more difficult. When you push, people push back, then you usually find a spot in the middle. Is that true? But, if you do not push at all, we give people too much room and say, “See, I knew it was not that important.” Only when we push do we get that idea. But the ideas pop up.

Now, I am going to go through these pretty quick because you all already know it. The argument:

1. Hike Tike construction is sealing buildings up, sealing up bypasses, and testing. That is central.

2. Improved thermal insulation systems. I am going to make this statement because I absolutely believe it 100%. Fiberglass batts, sorry for the Certainty folks because I love you guys, fiberglass batts should no longer be allowed in buildings. Okay? Why do you think that it is okay? Are fiberglass batts well installed? Have you ever seen them? How often? Not often enough. Come on, I am probably in as many buildings as anybody in this room, and I would say that I see fiberglass batts smashed, compressed, and jammed in. Let us be honest. Can you take a batt 14.5 inches wide and customize it for the cavity that happens to be customized throughout the building, and do it well? The guy said today that one of the most difficult things we have is trying to get the guys not to smash and compress the batts. As blown in insulation, which has been around. I put blown insulation, blown fiberglass in my first house in 1986. Certainty has a phenomenal record at blowing in beautifully installed, well installed fiberglass blown insulation.

Remember I had the microphone, I get to say stuff? I do not know if you guys got that the first time. It is like that Adam Sandler's movie, I get the microphone, you do not. Here is what I am trying to say about this, let us be honest about this. ________ Lab said that about 4% compression in fiberglass insulation can result in up to 40% reduction in insulated value; that is just with overage. If you look at the idea of putting in the insulation, could we look at the fact that blowing in the insulation in the wall cavities, cellulose, fiberglass materials, make a substantial improvement at a modest cost. (Someone in audience talking) Sprayed insulation. Should it be done? Should it be done? Of course, it should. Why are we all afraid to do that? Because everybody thinks it is about cost. Is it really that much? It is not that much, you guys. Blowing in the insulation in the wall cavities insures the insulating value. If you are a heating contractor, how would you like to know the insulation was well installed. If you were a heating guy and you are doing a low calculations, and you looked at the insulation poorly installed, what would you do? That is right. I would oversize. I would. The last thing I would want is a call from the guy saying, "Hey buddy, you blew it. You undersized it." When in doubt, add a ton, is a good motto. Right? If there is any doubt, I would add a ton. If the building was remarkably tight, well insulated, could we ask if the HVAC systems are remarkable well installed. Would that lower the other installed costs and help us with this issue that we are having now about combustion safety? Atmospherically vented appliances should no longer be involved in residential buildings, neither should orphaned water heaters. A water heater that naturally aspirates to the outside in a tighter enclosure is now being effected by things like clothes dryers, central vacuums, and a simple range hood in the kitchen. Is that true? Is it true? Yes, it is true. As you improve the tightness of the enclosure and you increase the possibility of depressurization in the space, what is the natural draft pressure of a water heater running by itself? Bruce, how many pass scales? About three pass scales of stack pressure. So, if I have a water heater fired, the stack pressure is about three pass scales, what is the possibility of me having a central vacuum and a clothes dryer running, and depressurizing the house to seven pass scales negative? What is the odds of that water heater drafting? The answer is put a really big hole in the room joist, right? (Laughter) Here is the challenge. We all assume that the combustion air line understands how much air it is suppose to bring in, does not it? When we depressurize the building, does not it uniformly depressurize the house on all surfaces? So, does it know where it is suppose to come from? Will a six inch duct to the outside provide enough combustion air for that device, or could it still back up as it is drawing from all of the other sources, like the garage and the attic? Understanding those fundamentals is for us to step up and say that this is not an opinion, it is not about saving energy, it is also about safety, too. In 1994, when Bruce first went to Minnesota, he said that we cannot outlaw it, and leave it in appliances. Let us just make it tough to do. So, he said to the builder that if he had a naturally aspirated appliance and the CFM capacity is over 150 CFM, what should you install? Makeup Air insulation. Makeup Air. The builder says that it is going to be more expensive. You know, you could go with this new device called a power vented water heater. It has been in the marketplace for over 20 years. It is $138 at Home Depot to go from a conventionally natural aspirated water heater to a power vented water heater. $138. Is there any savings in the vertical Class-B flue going through the roof? You are taking it out, absolutely. It is a reduce of penetration in the roof. Most of the people that sit down and do a cost comparison, a power vented water heater and an naturally aspirated water heater installed at the same price. So, if they are the same price, what should we be installing and encouraging? It does not have to be code. Should we be strongly encouraging that approach? Have you ever seen somebody try to put a flue through a house, a two-story house? I see them in the garage door, especially here. Out the garage, up the wall, up through a little closet space, and then I see a return duct next to the cavity. I said, "Okay, bad idea." Right? Bruce?

3. Enhance durability. We talked about how you wrap buildings. Oregon is now looking at the provision of saying that there must be a minimal of an eighth inch drainage space behind all cladding systems and rain climates about 40 inches. Should be a vented rain screen. Do you think that is going to happen in weather climates? Will there be an evolution of people wanting rain screens behind the cladding systems like you saw today at Co-Housing Project? Will you see that is where things need to go? I am just going to say, this is something that you will start seeing. Why today, did that Housing Project have a vented cladding? They had cement cladding with a house wrap and a venting space behind that cladding. Why would they do that? Were they were required to do that by code. Is it a really good idea for the building owner to do that? Because it rains here enough to provide that. Was he made to do it or was it a business driven decision?

4. High performance windows, solar heat gain co-efficiency values is a blight transmission to all stuff that we have in place, thanks to the kind of industry looking at NFRC as an idea to normalize performance, at least so that we can look at the sticker and have an idea what it meant. It actually means something and now we are including that into our software, including our calculations, and it makes a lot of sense. So, I think that those are great steps.

5. Efficient heating and cooling systems. Like I said earlier, do not think that there should be anything but a seal combustion, 90% furnace installed in every building built, and that is the way it goes. Will that have an impact on our consumption of energy in this country? Let us do that. The differential, everybody thinks, I heard somebody today tell me that it is a $1,000. I think when it started happening in Minnesota, going to the CO combustion furnace, they started having 90% efficient furnaces that were about $200 to $300 more per furnace. That was in 1994, 1995. Yeah. The gas utility provided a small rebate and so the overall differential and cost of not running the flue through the building ended up being a near wash to get high efficiency. Everybody said like, "Oh, that is 3,000." No it is not. Do the math. We started when that first code came up, the Builders Association came up with a little thing in the newspaper that said, "$10,000 to meet the new energy code. All of these people are going to be out of housing, what a disastrous idea." Everybody is like, "Okay, maybe we should not." So, we actually had a builder say, "Why do you not go price this for us and come back." The guy is like, "Well, it is like 3,000." 3,000? That is better than 10,000. Can you sell 3,000? Probably. Let us give it a shot because in the market economy we can have those expectations, so we should be doing that.

6. Bruce talked about ducts, Mastics, and Celium. I love the idea of putting it down a nickle thick and putting it on the ducts, and I think that it is really important. Is it a difficult task? It is more complicated than not doing it. It is a messy task. Is it something that should ever not be

done? That is what is interesting. You know what our benchmark is? Not doing it. Well, that is a good reference point. Yeah. I either do not do it, or I do it. Doing it is hard, so no. (Laughter) Should not sealing the ducts be even being an option? Of course not! What we should do is say that of course, you have to seal the ducts and you should not be putting them in wall cavities. There should be a wall cavity returns. That should not even be available. I was in Utah and I see four cavities panned off with the wire holes running through them. Right? That is a good idea. It is going to suck the air out from anywhere it wants to. Right? So, having a bucket with the holes in it, trying to keep it full of water, it is silly.

7. On the ventilation side, we already talked about that. Energy recovery ventilation has been around since 1980, at least in terms of the general market acceptance. In Minnesota, the saturation for energy recovery ventilation is about 70% of the homes get energy recovery ventilation and have for the last 10 years. It is a doable thing. But, you do not have to go quite that far, we could say let us just provide a good supple of ventilation and a good supply of fresh air. It allows a modulating damper on the return to bring in five or ten minutes of fresh air from the outside. Filter it and distribute it to all living spaces when people are occupying the space. Done. Right? It should not be hard, and it is not hard. It is easy to do. Is there a Honeywell person here? There was a Honeywell person here. Yeah, you guys have like a damper assembly? You have the control, it is called the XY85-4070. You guys have got to get new words for this stuff. It comes out as a super number that nobody can remember because I am always trying to remember it, but there is a really cool controller that they have with a motorized damper and return and it operates with the air handler. It opens up the damper of the outside, turns the furnace fan on for 10, 15, or 20 minutes, shuts the damper, closes off the blower assembly. If air conditioning on a day like today is running four straight hours, it only opens the damper just long enough to provide fresh air and closes the damper back up while it is still in the air conditioning mode. That is pretty inexpensive, is it not? We have to control. I think that fresh air intake and the return site.

8. Efficient heating of water. We know that this is starting to add to our overall load. We are seeing the percentage of water heating actually increase substantially, in terms of the overall energy load, because people are having a lot of demands for hot water. Tankless, high efficiency electric power or gas, is a piece of cake. Tankless water has been around for 20 years. We are just starting to see more of them.

9. Appliances. Whirlpool appliances with horizontal access machines. Imagine something using 60% less energy and 60% less water. Whirlpool is about ready to announce that most of their appliances they are going to sell worldwide as the largest manufacturer in the world of appliances, and they are all rated Energy Star. Should any person that installs an appliance that is going to last for 15 to 20 years, be it a high efficiency appliance product. Imagine what it is going to be like 5 years from now, or 10 years from now, in terms of a life of that product. We should install the lowest efficiency we can for costs today, so that when the price goes up in a few years, we are going to go, "Now, we are upgrading." (Laughter) Right? So, in the world of new construction, new buildings should be remarkable efficient. Is there return on investment when there is a 60% reduction in energy, to washing clothes? Less soap, less water, more

efficient operation of the appliance.

10. Lighting. We have complex effervescence, LEDs. We have all discussed the day light. I know that a complete glass building, that can achieve platinum is remarkable, because we have day lighting. (Laughter). So, personally, I think that we should really look at improving and the idea that complex presence and improved lighting systems that are long-life, just a fraction of the energy, that is something we should do.

11. We talked about water efficiency. How many of you still see sprinklers running while it is raining? People sprinkling the yard while it is raining. Anybody see that? Do we have the technology to shut the sprinklers off when it is raining? It is amazing. Little tiny sensor for $50 that mounts on the gutter. When it rains, it shuts off the sprinkler. Should we do that? Yeah? No? We should run it through the city municipal water system and then run it on the lawn while it is raining. It sounds brilliant! Why would we not spend $50 to make sure that we are controlling that? Is that an easy thing to do? Why do we not do that? Do we need a law to do that all of the time? Brian is looking for a law. Any kind of law to make us save water, and it seems like and interesting thing, and it should just be. Some communities now around the US are seeing it as their minimum requirements. You are not allowed to install any sprinkler system that does not have a sensor control on it. That is happening in many municipalities.

12. Site planning and layout. We talked about orientation, making sure that we try to get the idea about breezes, air flow, and sun.

13. Renewable energy. The opportunities of looking at wind generation and float able **tics**, that happens to be a project right in Sacramento, done by D. R. Horton. This is a project using tiles that are completely integrated with the roof assembly, and this happens to be in groupie homes in Rockton, California. Those are 2.4 KW systems in every single house that they build. INR is now building full communities in Central and Southern California, where every single house has float able **tics**. They are now requiring, under Title 24, to have remarkably efficient thermal shells. Efficiency of appliances at the same time, having some float able **tics**. Now, we will see the challenge with float able **tics** in the future, being that on a really sunny days, it is adding to the peak and we are having challenges with them making too much. Would not that be cool?

14. Materials. What we have for materials. You see that one we have in the picture, upper left, that is the new Georgia Pacific product called the XJ85. It is an eye joist that allows the space between there to be precut for ducts to be installed in condition space. So, now the guy said, “I use eye joist, I cannot put the ducts in condition space.” I am like, “Ha. I will be right back.” Right? So, engineering, marketing, and manufacturing can solve that problem. Boise now has 240 places around the United States that will take an eye joist and lay out the distribution system. They use a water laser to cut the spaces between the eye joist, so that you can get the ducts in the condition space. Now, there is no excuse for putting ductwork in the attic. There is nothing. You have open web trusses, you have the XJ 85, and the open cuts on the **Boceget** eye joist. Now we have a location to run the ducts. Can we supply the ducts between the floors in the two story house, with the second floor heating from the floor and the first floor is heated and cooled

from the ceiling, is that possible? Everybody thinks that you have to put the cool air upon the ceiling and that is only when the ceiling is running about as hot as our hotel was. We were like on the sixteenth floor and my room last night was 85. I talked to the guy at the front desk and I said, “It is 85.” He said, “Well, there is no insulation in the roof. It is just going to be hot.” (Laughter) What!? There is three P-Tech units in the room that cannot keep up with the roof being about 160, it is like it is, unusual. To what? To not insulate? What is that? That is a bizarre concept that we just accept as an approach that we should not be. It should not be happening.

So, if we look at buildings as complex systems that are interactive and changing, as the mechanical system fires up, it affects the indoor environment, the occupants, and the enclosure itself. Pressurizing spaces, when Bruce talked about HVAC. Is it possible to shut the bedroom door and have a pressure imbalance some place else? What do you think? Of course, it is. So, should we check stuff like that? How big can the pressure differentials be? I see master bedrooms with two supple registers in the master bedroom, which has a master bathroom attached to it, which has one supply register, which also has a master closet, which has another supply registry. Four supplies and how many returns? One in the central hall. Shut the master bedroom door, what are the odds of that space being under a positive pressure? The master bedroom is under pressure all of the time. You might as well just add some more pressure with the air handler, right? (Laughter) Some of you guys get that? You are suppose to say, “Yeah, no kidding, that is totally true.” I am just throwing out the truth.

If you think about that, if that room is under a positive pressure during air handler, . . . somebody just got it, I think. They, “Ooh, I got it.” Just kidding. So, if the master bedroom is under positive pressure, what does the rest of the house have to be under? Negative. How much? So, if the master bedroom is under 5, 7, or 8 pass scale positive pressure, does that mean that somewhere else in the building we have a negative when we did not intend to? How is the air finding that path? Should there be jumper ducts, returns, and things that we really design as mechanical systems? Well, imagine if we make the space more energy efficient, does that reduce the number of supplies we need in the bedroom? Which reduces the size of the relief pressure from the transfer grills; see how those all work together? Smaller and more simpler systems for every efficient buildings that have less overall system pressure. That is a good strategy. See, we are trying to find solutions to the entire thing as in a systematic way, looking at the buildings in complexity.

All walls that we build need to handle all of these characteristics, in every wall system, regardless of how it is constructed; commercial, residential, everything. Every wall system needs to control the flow of air, heat, water and vapor, rain penetration, light and solar gain, noise, durability, and provide strength for agility. Are those fair expectations? This was published in 1954, in the Canadian Building Digest, in CBD. That list there, it means that every time we build a wall assembly, we should check off those pieces. How do you get a control air flow? I do not know. I am insulating. Good job. How about water and vapor flow? Is that directly correlating sometimes in terms of moisture in the space, as well as the air flow in that space? Does it go through the walls of pressurized bedroom, puts warm moist air to the exterior of the building? Rain penetration. Has that been an issue in the past? And continue to be a problem? I am amazed sometimes, where I go out and see buildings that are still reversed flashed. In Denver, Colorado, I was there last Friday on a building site where there was a three year old building, $650,000 in the Stapleton Development Project, the largest redevelopment project currently in the country, with small mushrooms growing on the inside of the wood casing on the wall. I have photos if you do not believe me. I thought it was quite interesting. The builder said, “Well, we did a pressure test and the windows leak.” Really? Windows leak? When did that start? Do windows leak? Which ones? Every single window leaks. I said, “Well, how do you install your windows?” He said, “According to the **Alm** method, we caulk all four sides and then stick it in the window.” Beautiful. So, that when it leaks, it can only leak where? Inside. So, I do that math with them. I call it ‘guided discovery.’ So, when that window leaks and it cannot get out the bottom vent, where does it go? In. That is probably not good. No, I do not think that is good. (Laughter) Should windows be pan flashed if they leak? Of course! How long is pan flashing concepts been around? Pretty long time.

I was going to show you some pictures of the outside roof of St. Peter’s Cathedral in Rome, and the windows on the cathedral and roof are all pan flashed to the outside. They kind of wanted that building to stick around for awhile, did they? So, every window leaks. If it does not leak in year two, it will leak in year five, ten, or fifteen. But, the windows will leak. They should leak into a sloped pan, drained to the outside. Period. Are we increasing the amount of windows we are putting in buildings, that are wood framed, with wood sheetings, that are thermally insulated? Do you see a challenge there? When we continue to see water, moisture problems, and mold in buildings, as long as we keep doing that. . . I keep thinking, what is that idea or definition of insanity, right? Doing the same thing over and over and expecting different results. This year it is not going to, like, rain as much. Yeah. The builder said to the homeowner in that house that the reason why you have this problem is because it is one of the wettest Denver, wettest seasons on record. Wow! So, there has been a wetter one? Well, yeah, but this is like really wet! (Laughter) A compelling argument, I think, to a homeowner that has mushrooms harvesting on the inside.

This happens to be in Portland. Does this look like a design flaw to you? (Laughter) So, I asked the builder, I said, “I kind of think the window is a little too close to the roof.” He is a great guy, he said, “Um, yeah it should be fine.” (Laughter) Now, if you look at this picture and concept, when should it have been, of course, caught? At design, of course. When is the next time it should have been caught? At framing. But, the framing contractor probably did say something - “Hey, the window is framing up pretty close to the roof.” You knucklehead, it would have been caught in design, if that was the case. Right? Do you think anybody has ordered that window yet? I kind of think so. It is probably sitting in the garage as we speak. What are the odds that somebody, look at what the roofer did. Can you see? Put the roofing on, put the step flashing against the wall. When he got to the window, he was generous enough to cut it out at window opening and fold it in, so that it could work, right? What are the chances that you think someone is going to try and install a window in that opening? (Laughter) Do you think they will be successful? (Talking and laughter).

One of my favorite terms is that you cannot make this up. Okay? Is that happening? I asked the guy if he had done this before and he said, “Well, all of those.” Right? So, the problem is not that he is being negligent, nobody woke up in the morning and said, “Today, I am going to do a bad job.” What they are going to do is say, “Today, I am going to do what I did yesterday.” So, we seem to continually reinforce poor behavior, because people are afraid to call it out. This is bad. (Someone in audience talking) That is exactly what he said! He said, “If you saw that we are the windward side, we are going to be fine.” I am watching him go through and I said, “You have a little book with those?” He said, “I have a bunch of them.” I thought that was pretty good. Thank you for that tip though. I forgot about that. The direction of wind.

When we look at structure, do you ever think that we add enough framing, Simpson strong ties, turbo shields, and super shear, do you think we have done a pretty good job, considering that we could be in a seismic zone? Do you think we have done a pretty good job? Do you think, in some cases, we probably put just a little more than we need to? Just as a thought. I talked to some of the Simpson guys, and they said, “”You go to a building that has sheared all of the shear walls are in, plus you got the turbo fasteners, with six bolts going 9 inches with a torch wrench.” Right? Then, in the three story buildings they have the piece with a little cap on top where you screw it down with a certain number of clicks, so that the building in an earthquake can go, snap right back, right? So, we seem to invest a lot of money. Do you think that there is enough footings?

That happens to be in Vancouver, Washington, just across the bridge. We toured there today, Vancouver. Anybody on the Vancouver bus? I was on the Vancouver bus, anybody go to Vancouver? Sorry about that. (Laughter). You also see the square washers? Because I thought that was a brilliant idea. Remember how many houses we saw that were being torn off of their foundations because of their round washers? That became minimum. Just thinking of the things that we can accomplish.

Under investing and water management. The picture on the right is the project in Minnesota that ends up being seven years old. I took that picture. The picture on the left is, what I would consider, a reverse flashing concept. Do you think? So, if you look at somebody installing that flashing, for that band joist, that belly band, against that building. Should someone have stuck that back leg of the flashing behind the drainage plant? What they are going to do is they are going to put the siding down on top of that flashing, which now becomes . . . They are going to put the siding on it, will do what to the flashing? Negatively soak the flashing. What are they going to do in the gap between the flashing and the siding? Caulk it. When you look at that overall idea is to drain the wall behind the siding and store it in the flashing. (Laughter) Am I making this up? No. If you think about it, what could they do, but have the flashing? I told the guy that what you need to do, I do not know if there is a pen up here, I’ll see if I can do this. I told the guy that what you need to do is you need to get flashing. Now the options are as that the back leg goes like this, as I said, it slops up. The belly band sits like this, they put the siding in and caulk it like that. Right? All it would take is to go like this, about a six degree slope on there like that, have the belly band sit like this. The trim board, the deck ledgers, have the house wrap go like this, the siding sits like that, and you do not do what? Do not caulk. So, I said, “Do you think you can do this?" He said, "I cannot get that piece. They do not have that around here." So, being the smart ass that I am, I said, "Do you have the other one, the 90?" He said, "Yeah, they put it on the ground." (makes stomping noise) I said, "There you go." Right? So, this is not ingenuity really. The guy said, "I think I could have done that." I said, "I think so." Right? The answer for him was that you cannot do it, it cannot be done. Nobody has that kind of flashing. I will get it for you, just a minute. I should have gone and done it in the back, and then come back and said, "I just happened to have some in the truck. It's about $5 more a foot." I should have charged him for it. This is in Portland. (Laughter) I am not kidding. Some multi-family project, these are six-plexes and the sprinkler guy. I love this. Is not that just precious? I just love that guy. I do not know if you knew it, but crawl spaces should be continually sprinkled so that we can keep them damp. Right? (Laughter) Crawl spaces are a brilliant idea anyway, are they not? Putting wood frame houses on damp crawl spaces is a brilliant concept anyway, so I think that is something we should see if we can get more of. If it is not wet enough, sprinkle it. I think it is incredible.

The picture on the left, three years old and seven years old, in terms of order and time. It is pretty interesting. Do you see how significant the failures are? The mismanagement of water? I will show a little detail later on about some stuff.

So, the fundamentals. We all know the details pretty clearly. If we look at the conduction loses, we see that the framing, which is significant in number, we add thermal insulation and pull out the wood, we have a smaller amount of thermal insulation in those buildings. The overall net of our value in wall systems are, of course, reduced. I am looking at things like 20% or 25% of the wall area being frames, really a quarter of the building being just solid wood.

The opportunity of putting thermal insulation on the outside, you can see a drainage plane there. It is a drainage product by Dupont called Drainwrap. It is a vertically grooved house wrap and they put the foam over the top. Here is a house that is being done in the drainage plane. Windows are pan flashed and the ridged foam is going over top of that. We are seeing a lot more of this in improving thermal shell.

Sips panels have been around for, they say, somewhere between 40 and 45 years. Sips. How many of you guys have seen sips? Of course, is it a brilliantly interesting idea. Sixty to 70% less wood, remarkable thermal shell, incredible strong, incredibly resistant, very nicely built buildings, and we are seeing more of that. I built my house that way in 2001.

Conduction, as part of the flow of energy. This happens to be a project I was at in Alaska. You cannot put more holes in the ceiling and keep the Sheetrock on, I do not think. Right? This looks like someone took an Uzi to the ceiling and patched the holes with recessed lights, does not it? So, that can cause us a little bit of challenge with things like conduction and air flow of the building. We know that convecting looping and thermal insulation, when we stick it in the wall and compress it behind batts, it increases the ability for energy to flow through that batt, even though it says 19 or 21 on the batt. If it is compressed and smashed, it reduces its performance.

Solar radiation through windows into the attic spaces, when the attics are so directly connected. We know that Solar Heat Gain Coefficient gave all of this information, it is now being well communicated, I hope to a building industry and we are starting to see that the Solar Heat Gain Co-efficient is pretty steady, in the .36 range, is a piece of cake.

Tale of Two Houses just shows one house. These two are built exactly the same, of course, in design and thermal shell, and all they did was change the Solar Heat Gain Coefficient and reduced the overall load by a ton.

Air flow in buildings is where we are all pretty well aware of. We have wind effect, stack effect, and combustion in the mechanical systems. Each one of them competing on a windy day, and then looking at stack effect. In the climate, like cold climate regions we know that the stack effect alone, air leaving out through the lid of the building has to be replaced through some place else. Whether it is through the foundation and through some basement, some how that air has to re-enter itself back into the building. You guys are all aware of this.

Air leakage into the wall cavities and the pressurized master bedroom. More pressurized bedroom or any pressurized room, at all, carrying with it moisture, provides the opportunity for uncontrolled air flow, to again condense on exterior sheets. So, does that mean we need to insulate the exterior of the sheets? Do we need to reduce the pressures in the wall assemblies? If we reduce, thereby reducing the pressure basically in the room that it is in, do we need to seal or an air seal with penetrations? Which one of those do we need to do? Or is there a combination of all of them that would help lead you to this? The idea is that there is not one we can say is kind of hard to air seal. You have to know, but the impending damage of uncontrolled air flow is pretty significant, is it not? Warm vapor in terms of buildings, in terms of life style provide this kind of failure. The one on the left is three years old, the one on the right is seven, again.

Can you see this as being a water intrusion problem or could this be a pressure problem? Do you see any windows in this assembly? It is not a window leak, is it? What are the possibilities that there is a duct running on the outside wall, along that band joist that has the sealing finish to that floor, and all of a sudden the entire cavity became pressurized with the humidifier in the furnace? What is the chance of something that significant? They found a duct going into that cantilever space. That is interesting. Pressurized cavity in the rim, pushing air out through all of the water holes and penetration caused that kind of damage. So, looking at pressures and looking at air flow, looking at air leakage, we should be doing this and learning from that experience.

Sam Levinson has a great quote. He says, “We must learn from the mistakes of others because we cannot possibly live long enough to make them all ourselves.” I know. I am telling you. Have you ever tried to tell your kids that? Try to tell them, “Do not do this.” Like, right. You are just old. Right? I sense that you had 8-track tapes, and I did, actually. That is terrible.

On the air flow side, controlling air flow. Taking the layout of a building and taking an idea. . . You can see where I have those arrows. I just threw those in there, but you can see that air leakage between the house and the garage, behind the fireplace, box framing, tubs and showers, how often do we spend the time to look at where those air leaks really are? How about house to garage connections?

I am on the Board of Directors at Cold Climate Housing Research Center in Fairbank, and we have been doing some work there on studying how much air leakage is coming from the garage. As we improve the air tightness of the buildings, we depressurize the building. Where is some of that air leakage coming from? I believe when a blower door test is done, we should check the pressure, not only from the house to outside, but the house to the garage, the house to the crawl space, and the house to the attic, so that we can help the building industry to find where their leaks are. You say to a builder, you say, “Your house is at nine air changes. You did not make it.” The guy is going to go, “Okay. What am I suppose to do?” Just like, “Start caulking.” What if you said to the guy, “We did a house to pressure check it and we are 50 pass scales to the outside, we threw the pressure gauge underneath the door in the garage, pulled the door close, and found out we are only running 30 pass scales to the garage.” Do you have an air leakage problem to the garage? Would that help a builder know that there is a thing he can do, somewhere between the house and the garage, to seal one of the problems? House to the crawl space, house to the attic will give you some information about where to start looking. Going through that exercise, that is what I said to Bruce about having testing be something that happens more continuously. It is because people learn an amazing amount from testing houses. If you have ever been on a job site where testing, I have been on a lots of them where we set the target for the airtightness of the enclosure. Invited the heating contractor, the insulation contractor, and the builder to all sit there. They go like, “What are we looking for?” We are looking for three, okay. We were looking for CFM, actually, but that is easier for you guys. We are looking for 800 CFM at 50. So the guys were all there to do the blower duct testing and they are like, “How did we do?” 650. Yeah! Is that good? Did you want lower? You are like, “Yeah, lower is good.” That is it! We did good! Right? But all of a sudden they kind of saying, “So, what does 650 CFM mean?” You say, “Well, actually, at a pressure that we have picked, you want a certain amount of flow that the building is going to accept. Not 3,000, but 400 CFM at 50.” Taking a look at that pressure is helping the industry to know what they are doing. I encourage you to invite to tests.

I was in Bend, Oregon and I had a builder. I said, “How did you do on your blower test? What did you get?” He said, “Six.” I said, “Six what?” “I do not know, I got a six.” “What does six mean?” I do not know. The guy said ‘six’ and he left.” Right? I think that is the biggest crime there. Because we need to take the time to go, “Here is what you did. This is what six means. And if you wanted to get to four, this is what you would do.” How much time would that take? (Laughter) There is always just one. There is just one.

House to grounds connections. If you look at the diagonal wall with reference to the garage, how difficult is it going to be to seal the diagonal wall against those eye joists? It is going to be pretty tough. If you go in there and you say, “You have got to go in there and put a piece, kind of, stick it inside. Then, I do not know what the hell you are going to do, really.” Is this a design problem? I think it is a design problem. Yeah.

If we look at thermal bypasses, I just want to show these are infrared pictures, of course, the black showing up as cold air and infiltration. You can see the streaking lines depressurizing the space, and you can see the soffit cabinet, meeting up against the exterior wall of the garage, so you depressurize the space. All of a sudden, cold air pouring out of the garage, starts to chill off that soffit, and you also look at that line there.

In Minnesota, there was a time when we had the gas utility was seeing a lot of carbon dioxide monitors going off. They went into houses, trying to determine what was causing the problem. It really was not so much as back drafting and poor performing gas appliances, as it was that they started the car in the garage, let it operate for 45 seconds. The garage went to about 80 parts of it being carbon dioxide. After about 40 minutes, the house was at 50 parts of being carbon dioxide. Then, they filled the garage with a theatrical fogged, filled it with smoke, and they have a picture there with a fellow with the utility standing in the basement. It is bad, is it not? Standing in the basement, he still has the camera coming on him, standing in the basement. All of a sudden, he starting to disappear because the smoke in the garage is infiltrating along the bottom plate of the connection from the garage to the house. Also, they took a picture. They took a black mat and they laid that in front of the door, in front of the garage to the house connection. You could see the smoke pouring in, out of the garage. That was with exhaust fans running. Here is a house in the winter time and there is stack effect. Sure enough, the air is being sucked out of the garage. Is there anything in the garage we do not want in the house? Everything in the garage you do not want in the house. We are starting to learn how a car, idled, after it has been turned off, sitting with the garage door closed, is the only byproduct of that carbon monoxide? In fact, the initial start up was the highest rate of carbon monoxide. What else is coming off of that car, when it is hot and sitting in the garage? All kinds of volatiles from plastics, from carbon, and from a whole bunch of other stuff going on. Oils, solvents, and stuff happening.

Chimney penetrations and how we connect to the outside. This is using rigid barriers. How many times I see houses that look like this with the fireplace. The flue goes up the wall, they have some kind of turbo plastic, the white fire rated plastic. They tack that up there and it is all ripped, torn, and pulled off of the building. It needs to be a rigid barrier insulated properly.

Same thing behind bath tubs. When is that space going to get insulated? After the tub sets or before? Before. When should it get insulated versus when it is? So many times I still go to houses and I look in that space behind the tub and that they are hoping that a really little insulator, I mean a really little insulator is going to crawl behind the tub and the shower and insulate that properly, which of course, is not going to happen. This is in Cordyline, Idaho. Is the tub going to get set and then somebody is going to have to crawl back there and air seal and insulate that cavity. So, that is a design challenge.

Providing blocking. That is a material cost that is thermal applied that costs about, it is about $5 worth of material, put behind the tub, and then they blew the thermal insulation. This is one of the largest builders in the nation. This was in Sacramento by D. R. Horton. They air seal behind all of their tubs. They were not required to, they just did it.

Does this look like a fairly large hole? This is an eight-plex between the house and the garage. There is a big bunk of gypsum standing in the garage, so I get up on the top of it, and there is a small cavity in the garage corner. I stand upon the top and I take my camera and I just flash, so I can get that picture. I said to the builder, “That is actually a pretty big hole.” He said, “That’s a big hole.” Who is going to seal this? The hole guy. Right? There is a hole guy. He drives around in a big white van, got big black spots on it, he is the hole guy. He just takes care of holes, because what guy did that? Who sat there and went, “I can cut a great big hole between the house and the garage, and the hole guy will show up, once I get the siding to run something through there.” Is not that interesting? Is the house to garage connection going to be a problem?

This is their projects after we alerted them to these problems. Is that very complicated and expensive? All they did was decide the house to garage connection was important. They actually found the trade contractor’s drills that made round holes. Did you know they have those? You are suppose to use a saw to cut a square hole for a round pipe, that is the norm. As soon as we got them a new bit, these guys totally figured this out. It was amazing!

The benefits of air sealing is pretty straight forward. Reduction of energy loss, about a one-third of the load of the building. In some cases, more. Infiltration of harmful byproducts, which could be Radon, gases, other things, as well as from the garage connections, improved comfortless drafts, and of course, noise and dust. So we see the larger litigation issues that are happening now are issues of noise in multi-family projects. What are the ideas that somebody in one of those houses we saw today is going to spend $425,000 for a house and buy surround sound with t.v? What is the chance? Pretty darn good. So, the ideas of making noise become a big issue. So, one of the larger litigation issues that are happening.

On preparing for insulation. This is what I see, you guys. These are untouched photos. That is a 2x6 wall with 13 batts in it and not meeting, even filling the cavity. This is unacceptable, is it not? I had the insulator come over. I said, “Come here. You cannot do this. This is not going to work. You cannot do that. You have got to get the insulation so that it fits side to side and touches all six surfaces. It is what it says in the manufacturer’s instructions. It says, ‘The insulation must touch all six surfaces, be free from voids and compressions.’ Is that what it says?” So I said, “That is what you are going to have to do.” He said to the builder, “Well, if you want to do it like he said, it is gonna cost you more.” Really? So, to install it right, I got to pay more, right? Where in your bid does it say, ‘really shitty work’? I did not see that. Must be. . . (Laughter) I thought that was amazing that if you want me to do it right, you have to pay more, and it is only because somebody called attention to it. If they were to do batts correctly, I mean, putting them in, splitting them properly, pulling them out so that they fit the corners, touched all surfaces, would that now become more expensive labor wise than blowing the insulation in? See, the whole point is, doing it right the first time is the thing that we let an industry follow that approach. This is in Norman, Oklahoma. This is in California. How are we doing on the floor? Is the floor going to be uncomfortable for the space above this? What is the answer going to be? Add a larger HVAC, when all the answer is to install the insulation properly.

High density fiberglass can be put in well. I have seen them beautifully done. Put them in the cavity and carefully done. I am just saying, in terms of time and labor, I think it is easier to blow it in. High density blown in fiberglass has been around for 24 years now. They put up a nylon net and they build the insulation behind the netting. Every major manufacturer of insulation has a blown in fiberglass product. High density blown in cellulose insulation can do a phenomenal job if installed properly, making sure it is not too wet. Open cell and closed cell foams are now coming into the marketplace. We saw the flash and bad idea today in the daily project. Was it today? Great. I was so close. I know the day part, do not I? At Daybreak they have the flash and _____. They use sprayed urethane on the roof assemblies and then fill the ballast with the batt to meet ER requirements. So, is this going to improve the air tightness of buildings? Substantially. So, if you have tighter enclosures at the same time, are we being equally careful with the combustion air and the exhaust capacity and the ventilation requirements? Do they go hand-in-hand with this? Hey, the builder just chose to do foam, is not that awesome? Yeah. But, wait! Time out. What else are we going to do? Nothing. Does that put that client at risk and where do the codes apply?

Proper insulation is ensuring that the R value works, the low calculations match, the thermal comfort is provided, the sound reduction occurs, and energy savings is part of that. Right? Sorry about this, I thought I had one more in there. Those are all of those characteristics. Are those fair expectations of somebody properly insulating a building? Yeah. I think that is just what we have to expect. How do you achieve those expectations? Is this driven by purely by code or by improvements in the workmanship? Is that not important that they do both? I am a fan of codes, at the same time I am a fan of workmanship and craftsmanship. You cannot codify workmanship. You have to really encourage good workmanship. I think those are some things that all of us can help do.

Is there anyone in this room that is a building official? Have you ever encouraged, in a positive way, a positive response and got people to change? You can either go, “Forget it, this is bad, and here is a red tag,” or go, “Hey, you know what? Let me show you something.” You explain to them the proper approach and why, and say, “In our community and in our climate, I think this would really be a good idea.” You guys are the brilliant folks around, and helping someone through that process is essential. We have to do a better job. Period.

In the advance framing side, we saw that today. We took the traditional methods of framing where the idea was, ‘when in doubt, add another stud.’ Right? So that if four is good, five would be better. How about nine? Right? (Laughter) Twelve? Right? The one in the center, the guy said that they also needed to strap those two-bys, because they are about ready to fall apart, are not they? Is that a microlam or just a lot of wood? Right?

These are untouched photos. Is this a great big dumpster full of money? So, this is sloppy workmanship. I, personally, think it is the guy that is framing the house is building a cabin somewhere. I think he is loading that sucker up and he is also happens to be the garbage hauler; ‘why do not I frame and haul the garbage?” That is a brilliant idea, right? These are real photos from California, as you can see the housing there with all of the open framing. Those are all ready to be clad, that is about as much shear as they get. It is amazing.

We had the opportunities in advance framing. Improved thermal insulation, lower energy fields, cost effective, reduction in waste, all real positive benefits. Green or not, I do not care what color it is, I do not care how many points they get. To me, this is just the right thing to do. We have just got to build buildings with less material for more thermal insulation.

So, we have advanced framing, single top plates. We really look at the layouts of the wall cavities and the wall assemblies. We look at trying to stack that and reducing our overall load to about 17 to 20%. It is a piece of cake to do that. We can get down to 15%, but 17% would be great.

Some more numbers just so you know. They are from the Building America Project. Should framing cost reductions of about $1.05 a square foot, by going to advanced framing. And then, we saw the number showed up, the calculations for energy savings of about 30%, when they do it with the advanced framing and the opportunity is there.   So, getting to 50%, is that going to be easier than you think? You guys, it is a piece of cake. Getting to 50% is a piece of cake, as long as we do a bunch of things that are going to be opportunities. A little bit more here, a little bit less here. Should we help an industry know when to make trade offs? What I see is people putting the same HVAC systems in thermally improved buildings. Four hundred square feet per ton, as a rule of thumb. That is pretty good, is it not? I am like, "You got to be kidding me." Why I have been doing that for 20 years. I know, you still suck at it, the sizing thing, right? (Laughter) Because if we do not look at the thermal improvement of buildings, the improvement of the windows, the improvement of the shell, we are still using the same math, that is a problem. People think that they are already manual J's and all of the facts, the guy is xeroxing the thing, I think and sending it through. Just like I have been doing forever.

I had one guy, this is the honest truth, he is a little larger HVAC contractor in Lincoln, Nebraska. He has a company called Brand Heating and Air, and he is one of the biggest guys in town. He had this blueprint and he use to wear this big black hat. He would say that this is a three ton hat. He would stick it on the plan, if anything stuck out, he would add a ton. (Laughter) You cannot make that up, folks. I am serious. So, I looked at him and go, "Well, that ought to work really good. What about orientation windows?" " This has been working for me for years." Damn, that is awesome! I want you to heat my house, right?

On the moisture flow side, we also know that the ideas about the water and the way it comes, the moisture and the way it comes, ends up being in these mechanisms and we are pretty sure about the flow mechanism. We know liquid flow, in terms of gravity, and rain, capillary flow in terms of material of properties. Do we ever see things like wood stuck in the dirt? That is a good idea. But if you look around. If you drove around Portland or wherever you are from, and you drive around the older houses, the communities that were built 40 to 50 years ago, how far is the cladding and trim away from grade? A lot more than it is now. Right? Right now, homeowners do not want their friends to know that they had to put in a foundation. (Laughter) "Is that like concrete exposed?" "Yeah, we had to go like a space, I do not know what the hell that is all about." Right? So, it seems pretty interesting.

Tonight, we saw cultured stone finishing in the dirt. Is not that a bad plan? Now, what are they saying about cultured stone? It needs to what? Have a space between the dirt and where it terminates. How come? Is it not interesting how we expect brick to have an air space and weep holes, but cultured stone, just because it has a cool shape to it, is different. We call that lick-n-stick. Right? That is what the trade calls it. You take the back, you glue it with mortaring, you stick it on the wall; like that should be fine. Some people do not even put the mortar in because it looks cool. That is called the dry stack approach. I was in McCall, Idaho and all of the cultured stone is just kind of dry stacked, so that it has a lot more time for the water to stay in contact with the scratch cone, laying on a single layer of felt. So, that we know that does not make any sense.

On the air-per-air transportation site, per pressure induced in terms of water flow, and we also look at paper diffusion. How a building dries out, as we have looked at a better way of managing water vapor. How long ago has it been since in your marketplace, wherever you are from, they are installing polyethylene on the inside of buildings, not managing the rest of the moisture flow? You do not tape up the vapor retarder and the moisture gets through, how long will it stay in the wall cavity is there is polyethylene there? A long time? So, in this marketplace in Portland, they are using PVAs, and that is kind of reducing the amount of vapor permeate ability. We just have to make sure that we understand if the building leaks water and we expect that wall cavity to somehow dry to the outside or the inside we designed for that, and the best approach is to make sure that it does not leak.

Draining buildings and making sure that all of the water runs away from the building and off to the side off of the locations, running away from the building. How many of you saw at Daybreak today the big piece of flashing at the bottom of the siding? It stuck out almost two inches beyond the siding. I asked the guy, "Why did you do that?" He said, "Because we have a vented rain screen, we expect larger volumes of water to run behind the cladding, so we put in a little piece of flashing that is pitched to the outside, so that the water that runs behind the siding will be pushed away from the foundation." Well, that is a good idea. Is that not a great idea? So, there they have better rain management there, they flashed their details and penetrations. If you look in the. . . how many of you guys saw that they had all of the penetrations coming from the building and all of the trim blocks around there, but there was no caulking at the top edge and they had a little piece of flashing. The caulking was not on any of the top edges and they had a little drip return to push the water out through the face. Have you noticed that? That is being done here, pretty standard.

This happens to be here in the Portland marketplace. This was built by one of the largest builders in the nation. Is that a good idea? Because I had to qualify, did not I? Portland, and then design, and then a large production building. I asked the guys, "I do not think you really want to do that, right?" He said, "It is fine. We have been doing this in the Southwest for years." (Laughter) I said, "Oh, totally then, you should not do that here." It is awesome! "How long have you been here, you know?"

On the capillary flow side, this is also the South of here in Eugene. We could see capillary leaking, coming up through masonry materials. In the Oregon marketplace, it is one of the few market sites that I have been in, that they actually install the brick on the footing, down in the ground, goes down through their crawl spaces, build the walls the foundation walls, and they will start the brick at the bottom course sits on the footing of the wall. Not a brick ledge. So, they pull the brick all the way out of the dirt and then they backfill up against it and they wonder why they have some efflorescence. Is there a capillary break in that assembly? Not to interrupt any of the flow, they have all of the salts and everything else dripping down the ledge of the top side. Water rains down, hits the belly band, and runs behind the brick. Does this look a little too close to the steps? Yeah. So, you see all of the siding. This is cement siding and it is starting to get wet, get damp, and the siding manufacturers do not want to see this either. Do you think this column is a little too close to the concrete? I asked this builder, "Do not you think that the OSB should be sitting on the concrete?" He said, "It is okay, we will be wrapping that column in stucco." (Laughter) I said, "Oh! Well then, it is okay to do that because it is going to be fine." Right? So, does that need to be separated off? Could the bottom one foot band be a piece of treated plywood that is wrapped around the bottom of the band and still carried up off of the concrete? Is that going to fail when it is wrapped in stucco?

This is a guy in Massachusetts. He separates his porch columns off of that finished concrete and then he pulls those little blocks out and leaves it alone. What is the building industry creditably tempted to do right there? Oh, good, I am really good at this, I have this tip of a thing and I just fill it right in there and take my thumb and walk away from the caulking gun, right? I tell builders, could you build a house without caulking? Could you? Could you do that you think? Of course. Have we always had caulk? The Romans had caulk. Yeah. The super glue stuff, you know. If we look at caulking, I try to encourage builders. There are builders that tell me they will not let caulking on the job site. They said that what caulking does is that it creates laziness. When in doubt, put a blob of something in there. And the flashing and the details come together and it is kind of a big spot, they go, "Just put a tube in there." I see it all the time. I see blobs of caulk in spaces.

Air transported vapor in terms of just the general flow of air transportation. We talked a little bit about that, so I am going to want to go past this quickly. We talked about vapor transferring into wall cavities from pressure primarily and wind flow.

Vapor diffusion, in terms of an overall assembly, just to compare the last two. Through an air leakage, through a 4x8 sheet of gypsum with a 1 inch diameter hole, you can transport about 20 quarts of water over a winter season, and through an entire same sheet of gypsum, you can diffuse about one-third of a quart. We often have spent more time and interest in managing vapor diffusion which is the smallest amount of vapor flow. But, we have a little help managing the leakage of air, carrying with it moisture. We spend more time worrying about vapor diffusion retarders and the level at which we should look at the permeability of the cladding and materials on the inside and not thinking about air leakage. So, air leakage and pressure are probably more important.

Designing for performance is really building a building assembly that has the forgiveness of how you design that building. Gypsum board, semi-permeable latex paint, adhesive gasket air sealing, so that the building has some level of forgiveness. Does that change by climate zones? Of course it does. In an extremely cold climate, like Minnesota, Northern Wisconsin, Northern New York State, a lot of regions we really call that, I think zone seven, personally. But you guys are down to zone six, right Bruce? Yeah, I think seven is where we should draw the line, but six is pretty right on the edge. I think five is where they are at now. Is that right? Is five Class Two? Six? What do you think? (Someone in audience talking) Six, then. So anything above six needs to do a much better job of water vapor diffusion control, but I still think in some cases we are going to see a fairly low perm paint providing some forgiveness. I am not a big fan of polyethylene being at a perm rating of .06. I would like to see something like a smart membrane, but that is coming.

So, applying the principles. This is a feisty projector. Says that we need to protect our buildings as we are trying to design buildings, so we are going to talk about draining the assembly really quick. Integration by who? Whose job is it to put these pieces together? Who is suppose to make sure that the flashing in the picture on the left, from Dallas, Texas, where they for a long time were putting paint on the OSB to act as the drainage plane, which I thought was amazing. I do not know how they are going to integrate that flashing, but that is finished ready to be sided. The one in the center is in Colorado Springs. That is finished cladding, uh, finished sheeting. They are going to put that, the flashing is done on the wall, roof, interfacing, the step flashing, and as we speak, they are siding that with some end siding. No more integration. The other picture is just called sloppy, right?

Integration and we talked about this flashing connection at the belly bands and rims. This is in Cordyline, Idaho. You can see this is about a $3,000,000 house. Is that an acceptable visual? The homeowner wants that bottom course replaced, but she will have to replace the entire course so that it matches. What are the odds of the next door neighbor going to drive by because theirs looks the same and go, “Hey! My looks just like that.” What is the chance of the guy coming back that is going to do the same thing next time? It must have been like some bad wood. Right? Or caulk it.

Who do you think made the hole in the picture on the left? Who do you think made that big gap on the left? Which trade contractor? Any idea who might have done this? We are pretty sure who did it, right? He left his calling card. It is called an electrical box, right? So, this is being sided as we speak. I am standing there talking to the siding contractor and Said, “What are you doing?” He said, “I am trying to figure out how to patch that.” What is he going to do? A slurry of OSB? Kind of goo it in there and patch that thing up? How many people walked by that gap? Do you think? During construction? Because after the electrician, how many people went by and went like this, “That is a big hole.” (Laughter) You think? Because who is going to come fix that again? The hole guy. So, if we look at this, it is somebody’s responsibility and no one is quite sure.

On the cultured stone interface. This happens to be a three year old project. You can see that small shed roof on that chimney space. I was draining the water next to the cultured stone. The homeowner said, “I want you to take the stone off so that I can see what is behind the stone.” As they pulled the stone off, you could see that if we leave this reservoir stored cladding, laying on the OSB, the single layer of black paper on it, it is going to cause some serious problems. Is that a pretty big problem after three years? Who should look at it if you can? Look at that fireplace connection termination right here. See that fireplace termination, you can see the space underneath the fireplace termination. Do you think the top of that is properly flashed? It is like just a kit that comes up from the fireplace guy. He screws on the exterior of the wall and you go, “Who is going to integrate those two? “ There’s a guy that does that, right?

Space behind brick. If we are going to do brick, we are going to make sure that there is a drainage pipe behind brick. How long have we been putting an air space behind brick? A pretty long time, pretty long time. So, I think air space behind cladding systems show, in a very effective way, that they dry faster.

Even if you look at thermal sensation on the outside, it still shows there should be a minimum of a quarter of an inch behind that material so that we can get effective draining out of that building; weeps at the bottom, draining the water away. Do you think brick leaks? Are you sure? Absolutely it does. I have seen water on the backside of brick when we have taken off sections of wall just to test walls, pulled it away, and watched in two minutes liquid water begins to show up on the backside of the brick when you stand there with just a hose.

This happens to be a ten year old building. This is in the Central part of the US. Have you ever seen those water stains underneath windows? Here is that product being torn off of the building and you can see the result in the corner. Did somebody come back with a caulking gun? You see it? “Hey, the window is leaking.” “I will be right back.” He comes back, “How did you do?” “Eight tubes.” Right? “Where did you put the caulk? If there is a gap, there is caulk in it.” Right? I was on a project in San Francisco where they used 80 tubes of caulk. Did the building leak worse afterwards? Yeah. Because what they did is they sealed up all of the potential escape routes that were currently working. Right? So, the idea is that caulking will not save you.

This is the bay window assembly in the same house. If you just think of the poor homeowner, right? They got there, this is all torn off, this is a $200,000 repair to tear off stucco, replace the sheeting, replace thermal insulation, and in some cases, mold growing on the gypsum. So, walking by, how many people do you think they are walking their dog like this? “Hey, Bob, what are you doing?” The guy says, “Come on over here.” They take a look at that and the guy goes home like “Bull shit. I got some of those stains at my house.” Right? So, the builder had eight of these.

This is in San Antonio, Texas. Do you think it rains very much in San Antonio? Anybody from San Antonio here? It is pretty dry. It is not too bad, probably 20 inches of rain. These are what

I call drive-bys. I shoot these all of the time. Do you think that it was interesting that the guy could not get the step flashing into the gutter? Step flashing, even if he had wriggled the flashing into the brick, he still could not have, at the very last minute turn it into the gutter. Are you going to see a failure here increase at those places where the water runs past? If you look at the one on the left, you can see that the above gutter on the second floor had a down spout that they could not even get it to get into the gutter. That is a workmanship problem, is it not?

This is pretty catastrophic, as you can see. The roof line approaches more complex designs, . . . Anybody got a piece of paper here. I just want to show you something. I do not know if you guys have had a chance. I am sure that you have seen Joe do this. I borrowed this from Joe. It is the idea that if you look at roof designs, going from simple roofs to complex roofs, right? You have seen that? We just to have roofs like this and now our roofs look like (crumpling paper), like this, right? That is our new roof design. Yeah, there is a contest to see who can put the most dormers up on a roof is a new design contest. So, as we get incredible complex buildings, is somebody going to have to make sure that it actually works? Because we are making buildings more complicated.

A ranch style house with a simple roof, with nice overhangs works beautifully. That kind of roof, this does not work so good. Does it? How much rain is falling off for two valleys to dump into one spot? I thought today that it was interesting that that roof at Daybreak. They said that the water is going to come out of them scuppers and shoot just right into the space down below, those little culverts. Has anybody been here when it rains? (Laughter) That is going to come rocketing off of that roof, like a big hose, and I just cannot wait until somebody is standing down there, going to knock somebody over with the water shooting out of that thing.

This is the Waldorf roof interface on the flashing connection there. You can see as they pull that apart, the failure is right where that connection occurs. Too much water is concentrated. The ability to create a step of kick flashing that throws the water off of the building.

Finally, we have the issues of installing windows. Because all windows leak, they leak, most often, in the corners where the water concentrates. When the windows get installed, they actually have the tendency to flexspection the vinyl sides, where they have great big openings. The California Engineering Commission completed a study after 30 months that said hollow vinyl windows leak within two years. Twenty percent of hollow vinyls leak within the first two years. That is a pretty powerful ratio of leakage to a time frame, is it not? So, if they are going to expand and contract, what are the odds of that window expanding, contracting versus temperature variations? It is vinyl, right?

When I was out in Denver, the contractor had put the window in and had made it so tight around the assembly with brick on all surfaces, that the window could not move. When the window finally did move, it would bow to the inside and allow the window to do what? Leak when it rained. So, finally they had kind of worn out the assembly, nobody gave that window a design protocol for expansion and contraction.

What are the odds of the fin of the window getting broken off? Yeah. I have seen guys put the windows in with an air nailer and a sixteen penny. (Making sound) What is the chance of that maybe breaking the fin? Is this window going to get reordered? Yeah, it is the head flashing. Is it going to leak? That was in Alaska.

These are wall assemblies with traditional stucco three years old, three to five years old in a section in Woodbury, a suburb of Minneapolis. You can see that the failure rate of the transplant in the window and the water intrusion is pretty significant. Right? Do you think that now buildings in that marketplace and climate need to have a rain screen behind traditional stucco?

Does brick leak because the mortar leaks? So is not stucco kind of monolithic mortar that happens to be three-quarters of an inch thick, but of course, never cracks. Right? I have heard contractors say that stucco does not crack much. All you guys know of concrete, right? Concrete has two strategies. Concrete that has cracked and concrete that is gonna crack. Right? So that is just accepting the properties of the product. Right? Once you go, "Okay, it is going to crack." People go, "I do not know if I like those saw cuts." You go, "That is fine, we can leave them out and then let the spider crack. I just want you to sign off that you like concrete cracks anywhere it wants to." I like the lines fine. (Laughter) You just kind of explain the principle there.

Windows, as I said, are the connection points and how they come together. This is not adequate pan flashing. I asked the contractor, "Do you pan flash windows?" "Absolutely." "What about the corner?" "It is fine." It is not fine. This is not fine either. Peel and stick products that get cut in the corner. This is a brilliant idea. You have pan flashes like this, cuts the one critical spot, and then caulks the window on all four sides. That just does not work. It does not meet the laws of physics.

Here is the guys that put the window in. Do you think there is a small hole in the corner? Because the product does not flex. This is an untouched photo, right? You guys, you cannot make that up! I am serious. If you look at that, you kind of look at it and go, "How is the water going to just jump off the flashing, pass the gap, onto the fin?" You know. This is at California, of course.

Do patio doors leak? Of course. People step on the threshold. Should patio doors be pan flashed and drained? The house in Denver that I was at, the one that had mushrooms growing? They had ruined $10,000 worth of hardwood floors in that house. Was the window company going to pay for the $10,000 floor? No. What did they say the problem was? The builder did not do what? Flash it properly. So, the window leaked. This is not the solution, right? This guy told me that he uses two tubes per window. I am like, "That is awesome! That is the most I have ever heard used!" Right? He called that 'buttering.' Took the caulk and the putty knife and just kind of buttered it right into the side. That was amazing!   So, when that window leaks, and of course, will continue leaking internally. Pan flashing has been around for almost forever. We have pan flashing in all different varieties. We just have to deal with it properly.

Did anybody notice today _____. Did you notice today how they pan flashed the windows? They had those little corners, those little rubber corners, and they put those in and they had the house _________ over the top. They had the windows sitting in the openings and they were not caulked on the bottom. The only thing that they were missing was what? What should they do to the seals? Tilt it where? Out. You think that is obvious. I have asked, “Which way should it tilt?” “Hmmm, out?” “Yes! Good! That is awesome!” There should not be much of a delay there, at least in my opinion. It is just one of those things that you just ‘got it.’

Pan flashing. That is a product that is called Flexwrap, but it is really kind of cool. Dupont has it, there are other products on the market that also do that. You caulk it on three sides, you then insert the window into the opening. You place the flashing on the sides, in that order, and then of course, on the top. Then, you lay the paper down.

Should not every window installed be installed so that its flashed properly, integrated and layered, and then designed so that when it leaks, it drains to the outside. Should that we be done just across the board? And would that make an enormous impact on the fact that if we have 20% of the wall area as glazing, we should probably plan for its leaks.

Slopping the seals is a couple of approaches that I have used. This is one using a piece of beveled cedar. I have another one where the guys use two 2x4 on the bottom seal. After the window is set, we wind up taking a small club hammer or a little wedge bar, put it between the two, and then just drive a cedar sham. You will need about one-eighth of an inch pitch on that window to make sure that you are encouraging it to the outside. There are lots of ways of doing that. I had a builder that said to me, “I will just tell my framing guys to cut a small angle on that cripple before they put in the ceiling.” Okay. You think guys can do that? Trimmer said, “I can do that in a second.” All you have to do is, ask. Right? Could you do that? Sure. Do they ever bevel the corners, walls, and bay window assemblies? These guys can do that just like that (snaps fingers). It is just about asking. This is what we need to do.

You can see the beveled cedar went in, the flashing goes on, the flashing gets put in the opening, and then the window gets installed. You can see now that there is the whole windows pan flashed and ready to go. Are these products readily available on the market? Go to every lumber yard in this town and find that product tomorrow. The guy said, “That is expensive. It is $2 a foot.” Said, “Okay, what is your option?” “Not to do it.” Okay, let us do that.” See, as the basis, no money, again? Should the basis be a non-flashed window? Pan flashing or not? That is going to be expensive. What was your alternative? Pan flashing with this or pan flashing without? That is where you make your costs basis. A flashing system that works is what you establish as basis.

Here is the inside, they just use a piece of bacarode. They shove a piece of bacarode on the inside, into that cavity to kind of . . . The way they do commercial windows, shove the bacarode around the bottom on the inside, put a little layer of caulk to act as a back dam, or they could use bacarode all the way around, which is what they did. Here they bacarode all of the way.

This is an example of a technic and this is something that I just worked on developing, but I want you to see this. Just take a few. . . it just take one minute to do this, to see this. Tell me if this will be a helpful methodology for helping an industry figure out how to properly install windows. Are you guys having problem with the language on this one? (Laughter) Now I have that detail on my iphone. Would not that be cool? What if we just showed. . . Drake, why do not I just email this to you tomorrow, then you can do this just like that on the job site. Would not that be something? Is that doable? Do we have the technology for that? Did you guys see that video that they ran today about that high rise? Did that, at the beginning, look like it was real? Did it not freak you out when the helicopter flew between the railing and the light pole? That is when I had the idea that it might have been computer generated graphics. I am like, "Dude, that is a little helicopter, you know?" (Laughter) All of sudden you can see the people walking and you are like, "I think this might be fake." But, I think that it might be pretty impressive that we have the technology to create a method for our communicating that effectively.

This happens to be a builder in Denver, Colorado. This is the Stapleton Development. All of the house wrap is put on, the windows are pan flashed and drained, someone comes around to make sure that all of the penetration are flashed properly, and this is just a pre-siting insulation, that inspection. I think there are three times that we have to very carefully look at a building. Prior to insulating, making sure that we have done a great job of air sealing, right? Prior to the dry wall going on. It is kind of that sequence. Make sure the insulation is done properly and is air sealed. Prior to putting the roof on is when we should see and make sure that the flashing of the roof assemblies are done properly. I walk roofs all of the time.

On Friday, I was in Denver, I was walking on the scaffolding three floors up, jumped on the roof, and I see reverse splashing. So I get the builder, "Come here, you have got to see something. What do you think of that?" He said, "It is backwards." I said, "I know, but when should you check that?" He said, "I just got a new roofer." Okay, when you hire a new roofer, you might want to check to see if he knows what you expect. Would that wall have gotten fixed? Would it have leaked? And the idea of taking a look is not that difficult.

And then lastly, I think we should do an inspection of the exterior of the building. Not a code inspection. The builder should do these inspections himself. I think that they should really be carrying what the craftsmanship prior to cladding the building.

So, venting the cladding is the final thing we are seeing in terms of rain management. Vented rain screens. This happens to be here in Portland, one of the larger builders is putting up _____ strips on the side of the building, using a piece of treated plywood. The only problem is that you need to stay in those fasteners. An insect screen at the bottom to make sure that you keep the bugs out of that cavity, and they put the cladding over the top. This is a cement cladding going over the top of vented screens here in Portland.

This is another product called El Dorado Batts, invented by a company out of Sacramento. It is just a fluted plastic batten, an eight foot piece runs $2.00. They put that on the wall and that allows for ventilation, cross ventilation, back and forth. You can put it horizontally, vertically, and put the cladding over the top. The builder in Denver, Colorado is using these. He is putting up a piece of felt, then he tacks his expanded metal out over the top of that, puts a scratch coat on, and then he attaches his culture stone or the rest of his stucco to provide a rain screen behind his buildings. This shows the siding and the insect screen being placed for that cavity. That is kind of what you say today.

This is another product on the market called Home Slick. It has been around now for almost 10 years. It is probably about a little more than one-eighth of an inch and it comes on a roll. They roll that out on the building, it looks like kind of a stretch topped brillo pad, you put the cladding and the siding over the top of that. It allows drainage to occur behind the cladding. You put a piece of trim over the top. In this market place they still use spruce as a piece of trim. That should be against the law. Right? And, that is the cost basis. I say to guys, “Spruce is going to warp out, twist out, and fail.” They say, “Well, but going into cedar is pretty expensive.” Should the spruce not even be an option? You should not be able to put unprimed spruce on a building. I am sorry, that is called interior trim. You do not put that around the outside of the windows.

The common holes that get missed, we talked about all of these penetrations and people making holes with hammers and pretty, pretty big deals. This is again, an untouched photo, this was in California. What tool is the contractor using to make this hole? (Laughter) Serious, it was amazing! You would think. It should have been his head, knucklehead! He was coming up with a sledgehammer, *klablaamo*! I said, “You have got to be kidding me. You have got a drill, right?” “Yeah, it is in the truck.” Well, you might want to go get that.” “Well, how come? I do this all of the time.” Get my point? That was the point that I made earlier. We re-enforce bad behavior. If I was a builder and I saw that one time, what would you do? “Hey, buddy! Guess waht you get to do today? Buy a whole new sheet of sheeting. You get to take that piece off, put the 400 nails per sheet back,” is that not what we require now? 400 per sheet? There is more nails in there as material. So, you pull that piece off, make him get a drill, drill the hole correctly, and put it back on. Is that going to motivate him next time not to do that? That is all that re-enforced behavior. He said, “I do not buy sheeting.” “Then, you do not work for me.” That is how you re-enforce good behavior.

Penetrations like this, I do not know what the guy is thinking. Somebody is going to come back with a sewing kit and patch the tie, right? You know, my mom will stop over and sew that up, I swear. This is another example. This is called completely irresponsible. This is irresponsible behavoir for whoever did that. What would it have taken for the guy to take a small knife and cut a hole? Right? So, these are workmanship and craftsmanship issues.

It is easy to provide flashing and counter flash the piece. There are products on the market like that called Quick Flash. This guy that invented this for 19 years repaired the problems and flashing failures in buildings. He invented a little product like that that has this little **leopreme** boot . He has like 16 or 17 sizes and those boots cost between $6 and $7. Can you imagine the plumbing contractor going up on the roof, takes his heel, smashes his heal through the roof deck, runs the vent pipe and wraps the little felter on it, how would that go? You know what the problem is? How does the roof boot get flashed? How do they flash those penetrations? With a boot that goes over the top of the little collar and they slide that over the boot. That is necessary to roofs. Do not worry about it in walls. Does that not seem bizaare. The catch is that it is cause and effect. When a roof leaks, how soon do you see the leak? Right away. It is an immediate motivation. You look up and say, “Oh, the roof is leaking.” Right? On the roof it is also ventilated, is it not? Have you ever seen us try to minimize penetrations in the roof anyway? Does the industry try to minimize penetrations? Of course. You minimize penetrations, there is soffet venting and ridge venting, just in case you get a little bit of moisture in there to remove some of the built up heat. Now, you have a building assembly that has minimized holes, penetrations are properly flashed, it is ventilated for forgiveness. I am going to go like this. Now what? How many holes in the wall? As many as possible, right? Is it ventilated for forgiveness? No. When does the homeowner or client see the leak? When it is too late, yeah. When it is too late. Usually, when there is fairly significant damage. The motivation has to be that if the walls leak, so does the rest of it.

Finally, in the testing for performance aspects, Bruce talked about the pressure testing of ducts, the blower door testing of houses, and the using of infrared cameras. Infrared cameras are all in the range between $7,000 and $8,000 for an infrared camera, not $25,0000 anymore. I was the only guy that bought the one for $25,000. Anybody want to buy a really nice infrared camera? Those tools for testing; all of you, of course, have been on job sites and have been in projects where they use those tools, right? When you have been out there and you see those tools used, is it a remarkable experience? Have you ever looked at an infrared camera, looked at a wall and seen how poorly insulation can perform? You see the studs are about this wide. That just shows you the lack of insulation contact at that exterior wall cavity.

Our industry, the building industry, is changing, right? (Laughter) Is it? This is from South Goens website. If you just look at this detail, that is untouched. The guy that is driving the paint stripping truck was doing his job and he is not the guy that is suppose to move the stick, is he? There is a stick removing guy that is suppose to go ahead. So, you are driving the paint driving truck, you are like, “Whoa!” Right? What are the odds that someone is going to, driving down that road, follow the line? You know? If you have ever been to Hawaii; I was in Hawaii. I was in Kowai and I was looking at them painting the road and that line went like this. If you just looked all the way down the road, it is okay. Right? You have rum in Hawaii. So, certain places it really does not matter. I looked at that and I said, “In Hawaii, it does not matter. I think in most areas it does.”

This is a builder in Pennsylvania and he is in Philadelphia. His name is Don Pollack. What a phenomenal individual! Tremendous builder. He and his brother have built houses for 30 years, mostly in the higher upper bracket range. What a phenomenal individual! In order to make sure that he is doing his houses right, he decided to build something quite revolutionary. It is called a ‘mock up.’ How revolutionary is that? Not very revolutionary, is it? You just build wall assemblies and that is a stucco contractor, and he says, “Guess what? This is what we are going to do. Put on our house wrap, put on our flashing properly, put that home slicker on, then we are going to put a piece of black paper over the top, then put the lath on, and then put the stucco over the top, okay." That picture is five years old. He put that on his job sites and told everybody, "That is how we do it here." Everybody would walk over and say, "Okay." Right? So, if you look back and you do it wrong, he said, "If it does not look like that, you get to do it again." Right? That is a pretty good motivator. Why do you not make that look the same? Okay. Do I need to even speak the same language to get those two right?

We are going to bridge these language barriers, not by just translating things to a different language. Is it possible that somebody that speaks a different language is also incapable of reading? Is that possible? Are there people that live in this country that speak perfect English, but cannot read? It is just a fact. Are there people that speak foreign languages that cannot read? So, suddenly we think we are doing everybody a favor by translating the language. You really have to find a way to communicate effectively through the idea of using demonstrations.

Finally, these are some of my pictures. This is me staying in Denver, Colorado. For the last 25 years, I have been building green houses. What they really have been doing is just building great houses, and when the green came along, he said, "Well, we already insulate incredibly well, We pressure test and blower door test our ducts in our houses. We make sure that all of our houses consumed at 30% more efficient than the current state building code." Is that a motivation for marketing? Is that not cool? Do you think people are at all interested in that kind of information? What do you think? Some people say "no." Some people do not care, do they? Do some people care? Of course! Some people care, some do not. It is okay. That is called America. You get to chose. It is a great thing. You get to pick.

This is in Denver also. Those are Flow over tags through the hot water system, that is an 8QW PV system on that house. I was there the other day and it was about 11:00 in the morning and it was about 6KW. That was pretty cool! Do people like that on their house? Having that system there? Do you think? Yeah. The people that have it, do you think they tell their friends about it? "Guys, come over to my house, I have solar. We can cook on the patio free."

This happens to be in February in Denver and everybody has coats on. It is snowing. The builder decides to have an Open House three weeks earlier, and in Denver you never know. It can be 60 and it can be snowing, all in the same week. It is an interesting climate. Everybody came to this demonstration house. Two hundred fifty people on a Saturday, 200 people on a Sunday. Bad weather, everybody came. In the Stapleton in Denver, and they showed up and were standing in the basement. That is Dave Shrock in the back. He is the HVAC distribution guy that owns the distributor there, showing flow over tags and the tankless water heaters, and the heat pump, and the whole systems. People are standing downstairs and they were listening to him talk about stuff. It was really cool. He got done and said, "I have never had so many people stay so long." Was the builder excited about that? It is a lag time of people inside of houses. If they walk in they say, "What do you think about the house?" "It was okay, I just did not like that blue couch." It does not come with the couch. Right? The problem with that is that we do not communicate effectively to buyers what it is they are looking for. We let them walk by themselves. So, people walk through a model home and say, “What do you think?” “This is pretty nice.” “Good. You want to buy one?” Is that not interesting? You know, walk people through.

Vernon Macount in Oklahoma, in Normandy. He is one of the finest builders I think that I have had the pleasure to meet, building in a really interesting price. Probably between $185,000 to $300,000. He makes the sales agents walk every single buyer through the house and he has to show them one feature and one benefit in every room that they visit. He has to visit at least three rooms before he lets the homeowner go on their own. This is about really communicating effectively with people and finding out what they want.
This happens to be the energy cost in dollars of that particular house in Denver. You can see the IECC code house, you can see the Harvard Standard house. Harvard Communities is the name of the builder. The nearest energy house is the bottom one in purple. They are doing a remarkable job. In 2006 he built 28 houses, 2007 he built 26 houses, and last year he built 25 houses. He is doing okay. How is he selling in terms of communicating? In the down market, he is just communicating effectively with people that they think that is an option.

For additional information, do any of you guys read your own Light Construction, Fine Home Building, Energy Star, Building America, Green Building Advisory. These are all some websites. Is it okay that I put PNL on there? I know who paid for my hotel room. These guys are cool. There is a lot of information out there that you should be accessing. There is IECC, there is a whole bunch of other places that have tremendous information available.

If you do not have any copies of the Builder’s Guide, some of you guys have copies of this? This is written by Joe Stebert. Joe’s books? Beautifully done. They have been in publication for a long time. There is one for each climate zone, 400 to 500 pages, 250 to 300 illustrations, and they are available at the bookstore, at the www.buildingscience.com website, but if you do not have you have to get one. You just need to know how the details from design all the way through completion are done. There is a ventilation guide written by Arman Rudd, an insulating guide written by Chris Mathis, and a water management guide written by Joe. If you look at those kind of details, those little guides on the far right. They cost about $18 and. . . I have had a building community that I have worked with in Jackson, Wyoming that actually made the contractors buy one of those. Right? The city could actually buy it for you and with the building permit, you pay for the permit and you get a guide book that says what you should do. Just a suggestion. It is called a ‘best practices guide,’ and we just recommend that you follow this approach. Is that a way to do it? A motivating market? If we did that early, . . . When Bruce started doing the things in Minnesota about 1992, we did what was called the ECAP Project, Early Code Advancement Project. Myself and Pat Hellman would go to all 20 regions of the HBA’s around the state and do a one day training course on building science and building physics. That is it. So, that when the code came out in 1994, everybody was like, “Okay. Fine.” Because we explained why. It was not the government doing this to me, it was just this evolution of well, this is the way the physics works, this is probably how I should build, and it was a little less of this.

After the meeting today, I am going to be meeting John Chandler from the State HBA. He called me this afternoon and he said, “Somebody told me that you were here. I would like to sit down and figure out how we are going to get our builders properly trained to make sure our buildings work effectively.” There you go! That is called a partnership between industry and government. We are going to find a way to do that. I think that there is a better way to that. Bruce has found that in Minnesota. He has the HBA and him working together on code changes. They say, “This is what we are going to do. What do you guys think?” “Oh no!” “Okay.” Bruce, in his own way, and if you know Bruce well enough, he is able to guide people around and they do not even know where they went. You know? (Laugher) They get done and they say, “How the hell did we get there? I do not know. Bruce took us on a trip somehow. He put something in the coffee, I do not know how he is able to do that.”

There is a series of CD’s on building sites that you can get, and those are through Tot and Press. I want to leave you with this last thought before we talk about some questions. John Ruskin said in 1819; this was in the inside cover of Joe’s book. It says, “When we build, let us think that we build forever. Let it not be for present to light or present use alone, but let it be such work that our descendants will thank us for.” See, the motivation for what we are doing and why we are doing what we are doing is not about us, it is about a responsibility to each other and to our children and their children. You guys think sometimes that this is a big sob story about poplar bears and ice cap melts. This is about really understanding what is going on. What is happening to our environment in terms of the fact that we have gone from three billion to six billion people in 50 years? Charting new territory? We do not know. Everybody wants to point a finger and say, “Somebody does not get it.” But, neither do we. Something is going on. We probably realize that we have to do something different.

Does the consumption of energy and the saving in dealing with carbon really make a difference? Do we believe that? Do you guys believe that it will make a difference? We try to reduce some of our carbon footprint. But more importantly, we build buildings that use less energy for this country. This country, the United States, should be in a much better position than it is, in terms of its dependance on oil from other places, energy from other places. As a country, could we have done a better job since the first oil embargo to now? Amy **O’Leven** said that if we just would have left the requirements that we put in place in 1974, we currently would not be importing any fuel, any oil from the Middle East, as we speak. Would that not have been awesome? We already know that is true. We can go back and do the math; so, we say, “Fair enough.” We did not do it right that time, now we are going to do it right. What is that going to look like? We are just going to slowly and steadily, or preferably a little faster, improve the way that we use energy, the way that we produce carbon, the way we produce waste, and the way we use resources. How we are going to be motivated to do that is all about choice. We can either force people to do things or educate them about making good decisions. That is what we are trying to do today. You guys are now people that are going to go out into your marketplace after the last three days, learning everything that you have learned, and begin the process of transferring this knowledge and information to the next batch of people that were not here. That is your job now. Starting today, you take everything you learned and everything you have seen and you start talking about it. This is where things are going, this is what we are seeing happening, and start moving the message across, because it is not something that you have to convince people of. We just have to explain what is going on.

Use that term, 'guided discovery.' When you explain things along the line, when someone gets to the end, you say, "So, what do you think?" You probably should do that. All right, let us go! See, is that not fair enough? If we take that approach, this code stuff does not seem so looming. You say, "It is going to happen in 2012. Oh, it is going to be bad! People are going to be pissed." Right? So, we take that approach and then everyone is afraid to stand up and say, "This is what it should be." That is what I get to do, because I have the microphone, and then you guys get to help make sure that it happens. Go forth and change the way we build buildings, because it is not that hard. Really. We just have to say, "Okay," and this it happens. That is all I have for you. Do you have any questions at all?

(Clapping)

I think that they have some mics around so that we can ask questions for a little bit. How much time do we have? Oh yeah, right. She had her daughter step on her toe. What time is it? Perfect! We have some time, so if you guys would not mind, it would be worth asking some questions. So, any questions? Yes, sir.

MAN: All of this stuff is well and good, but as you know, for each thousand dollars of cost that you add to a house, you eliminate 213,000 people from the housing market, and further, you eliminate many products from the marketplace that reduce the choices available to housing consumers. While this is all well and good, how do you address the question of these onerous costs, driving up housing costs through the roof and just putting everybody out of business? How can you do this?

MARK: He is full of shit, is he not? (Laughter) First, I thought he was at that HP and then I am like, "No, that is a bunch of b.s. what he just said. I cannot believe it." It is very important, because what he just said is what we just hear, is it not? So, what are we going to do about that? Because, if what he said in the way that he said it, is it wrong? What we have to do is find a way to prove the fact that for every. . . at $6 a thousand for borrowing money. If you add $3,000 to the price of the house, that adds $18 to the mortgage payment. For $3,000 can you get $18 in savings? So, does that then provide the fact that Canada, when they do qualification ratios, it is principal interest, tax, and energy. Not principal, tax, and insurance. Nice job insurance lobby. Yeah! Right? You get the qualification ratio and that is like called good lobbying. So, who is the lobbyist for energy conservation in terms of making sure. Should the qualification ratio for a loan not be principal, interest, tax, and energy? Because is that not your big variable? If you found a way to say, "Actually, because the house is going to be thermally efficient, you will be reducing your overall payments per months and your expenses per month by $30. We will be glad to lend you $18 more to save $30." The next problem that we have is the appraisers. The appraisers look at a house and they look at this project, and you did a really nice job, and they say, "I am sorry, I have to do a comp on that. It does not qualify for any of the comps. So, all of those improvements that you did, tough." Right? So, the industry is looking to currently. . .

Here in Oregon there is a group called Earth Advantage, and they have been working with the state, the Department of Energy, to really come up with a better ratio of savings. The showing of houses that are built better and more performance enhancements and green, and stuff like that, are selling faster. There is a high absorption rate in communities that are doing that. Houses are actually going up for sale less often, which is quite interesting, because people really like the comfort of their house. So, taking that data, now trying to roll that into the appraisers community. So, now when I do my comps, I say, "The comps of the house are $200,000, but because it is rated or it has this score to it, it gets a 1.25 multiplier on its comp." Would that not be a cool way to do that? Then the comp he says, "Okay, your house is worth $25." Awesome! We have those values.

Taking people out of the borrowing pool, here is what is interesting. In Habitat for Humanity, they have been working on projects at Habitat, originally saying that all we have to do is get people into houses. That is the most important thing, get a roof over their head. That turned into a really bad idea. Do you think that Habitat gets into enormous trouble when their buildings leak and they have really serious performance problems? Does Habitat get into trouble for that? Absolutely, they do. The people that bought the house, even at a lower price, still bought the house. Now, they expect something to happen. Have they ever had any litigation issues for water intrusion? Absolutely. Guess what they have decided to do? How many of you know the wonderful man that lives up in Seattle, his name is Marty Costra. One of the really fine people with Habitat. I got a chance to work with Marty in his very early days as Director of the Habitat operations in South Dakota. He then moved to Georgia, where he was there for quite awhile. Up in Seattle, he is building these absolutely amazing Habitat Houses. What he is doing right now is he is flashing them properly, all of the drainage planes, insulation, air sealing, ducts in condition space, designing them right, and he said, "You know what? I am whopping the builder across the street and it is not like we are doing this for free." Now, he has a little bit of labor benefits, does he not? Yeah, some of his labor is a little cheaper. Marty has done a phenomenal job of saying that I have been demonstrating that if we can build Habitat Houses incredibly well, it is just the way that we have to move forward. So, that means the people who have a lower income in many cases, have issues with upper respiratory. We see that to be pretty solid in the data from the American Lung Association. We have to be careful with indoor air quality, so you have to build really great buildings with ventilation for occupancy and filtration for fresh air for people that have upper respiratory or other problems.

Also, in the people that have lower incomes really need to make sure that their energy bills are affordable. So, if we build an energy efficient buildings that are incredibly healthy and durable, is that not something that everybody is suppose to get? In England, every contractor that builds buildings in England, commercial or residential, has to build 20% of their buildings, have to be social housing. The way that they changed the market in England, in London especially, is what they said was that everybody that builds social housing has to exceed the performance criteria of the Art 2000 program in Canada. So, they are building social housing that whipped the stuff that they are building for non-social housing. Guess what that did to the marketplace in a non-codified marketplace? I suppose we should build the stuff that we build for everybody else, at least at the level of social housing. Pretty interesting motivation, right?

Trying to bring up that overall bottom, and part of the challenges right now with the NHAB, and that community is really what they want, is nothing to change. How do you deal with someone that does not want anything to change?

MAN: (Yelling) Tell us!

MARK: I am trying, man! (Laughter) I saw this really cool little cartoon that showed a guy, there is all of these guys on horses with arrows in their backs, and the guy is standing there and he is talking to this guy with the Gatling gun, and the guy said, "Can't you see we are busy? We are about to fight a war." Right? The idea is that does the technology provide us with a way to change costs? What we have to do is demonstrate. How many of us has done enough case studies that demonstrate the efficiency performance and true cost of buildings? Does that exist out there? Does it? Somebody else in this room, does it exist? He just wants to be "NO!" Somebody get him a beer, please. It will soften him up a bit. Is there case studies in the marketplace demonstrating high performance houses that are affordable to operate, they cost less to operate and purchase than a conventionally built house? Does that exist? Yes it does. What we have to make sure is that everyone that said, "Yes," in this room, bomb the guy's email, just fill his email with that stuff, because he is right. He needs that. He is being really honest about the fact that if we are not able to clearly communicate these obstacles, then we are going to be just in the same situation we are in. We are always defending better buildings. Like when we have a, "Good for the planet" We should say, "No it is the only way you can build." My problem is the basis is a bad place. We have excepted even less than code as basis. That is what is difficult. How do you change less than code as basis? Have you ever walked in the projects, you guys, and seen houses that do not even meet minimum code? People think that the code is the pinnacle. "I made it to code." "Good job!" Right? Have any of you that do look at buildings, are you ever excited when you see a building that exceeds minimum performance criteria? That is a pretty good thing. How do we demonstrate that better in the marketplace? All of this is going to take a pretty interesting effort, but I am doing my best. I talk to 10,000 builders a year, I am working on it. How many do you speak to in a year? See, keep going. That is what I am saying, but we have to say it in all of the positive ways. This is not something that you cannot do. This is something that you can do.

I remember someone said this thing about a teacher. She said that all of the students were sitting around saying, "I cannot do this, I am too heavy, too fat, too slow. I cannot do this." She said, "I had enough." She said, "I want everybody to make a list on a piece of paper of everything that you cannot do." They put this list together. She had a shoe box, filled the shoe box full of all of this stuff, marched all of the kids onto the playground, and buried the box in the dirt. She said, "There are now no more 'I cannot's.' There is only 'I can.'" When the kids say, "I cannot do that." Oh, no, no, no! We buried the 'I cannot's." All I am trying to say is this is an issue of attitude. I keep saying that it is about attitude. As soon as you change that attitude to say that it is possible, it happens. As soon as you say that it cannot happen, it will not. I believe it is that simple. Nothing happens unless you choose to make it happen.

Remember the quote from Margaret Mead, “A small group of thoughtful people can change the world and in fact, it is the only thing that has.” So, if you are ever thinking about across this world, how many one person has made a substantial difference in changing the entire planet by one person wanting to make a difference. So, be that one person. You have a ton of friends to help you do it. Who else? Anybody else? That was a simple answer, huh?

MAN: Mark, you partly answered this, but I want to come back and defend the builders. I think it is, it is not good. They are neither good nor bad. They are not uniformly bad. It is really nice to get in a room and find the person who is not in the room and pick on them. Lately, the builders are doing better. In the code arena, I do not think that it is primarily builders, I think it is the product makers going to war with each other that are the primary impediment. My question to you is, you, and a handful of people, are pretty effective at communicating. I think the audience you communicate to most importantly is not this audience, it is the builder audience. You, and a handful of people, are effective in doing that. Why are you so effective?

MARK: I think I also want to correct something you said first. You said that I am hard on builders. I am not hard on builders. Builders are doing whatever they think they should be doing, and they repeat today what they did yesterday. So, all we have to do is find a way to change that, but I think that builders are actually pretty remarkable individuals. They are the people I like the most. How could there be a better career than building houses? What a phenomenal thing to do. You put people in homes, what a great gift to anybody! What an amazing legacy you get to leave. You build a home with families - five, six, seven families will get raised in this gift that you have given other people. A house. What an amazing thing to have! What does a computer programmer get to say that he did? What did you do today? I wrote some really good code. I was like moving ones and zeros all day long. Right? But, the building industry gets to say actually, “I did that.” Has anybody ever seen a house that was built or builders that built houses, I always tell this all of the time. When you build a house, do you ever go and show your friends? Yeah. All of the time. I did that, I did all of those. When you go on vacation, do you ever look at houses? Yeah, you go to get a cup of coffee and two hours later you come back. You are crawling under the fence, crawling through houses saying, “Oh that is pretty cool, right?” “Where have you been?” “Cutting the line, it was too long, really long.” Right? So, I find myself looking at houses and that is what we do. Is that not cool? To be a part of an industry that you love that much? So, Craig, I love the building industry.

The problem is that I think that the art of communicating effectively comes from everybody. Material manufactures in one way do create problems. They create missing information. One company says that I saw the guys that did spray foam; their add said, ‘Spray the foam on the wall cavities. You no longer need a house wrap.’ That is what they had in their ad. I called them up and said, “You guys, that is flat out irresponsible.” They said, “Yeah, but if you spread the foam on the wall, you no longer need a house wrap for air infiltration.” What about for water management? “Hm. That is not our responsibility.” “You just made it your responsibility in that ad. You just said, ‘You no longer need a house wrap.’” So, they missed the whole point on the physics side. You can now say, ‘improve the energy efficiency and reduce drafts in the house,’ but do not tell them you do not need a house wrap. That was really stupid. Very irresponsible. I am personally fighting with a few manufacturers right now that say that all you have to do is tape the seams on the sheeting. I am having a little hard time with that. I am trying to figure out how you tape sheeting to make it weather proof. How do you get the window fit on the head flashing, wrigglet into the foam, wrigglet into the sheeting. I was in Atlanta last Monday with one of the largest manufacturers of turbo super sheeting, zip wall, and zip roof. It says that now you put the OSB on the outside, you have this really cool coating, and as long as you do a great job of taping all of the seams and joints, with our super tape, it is pretty cool stuff. It is acrylic tape. You tape the head flashing all of the penetrations and everything with tape, and then you clad rate over the building, no longer a need for house wrap. I said, "Well how do you get that head flashing in there? Should you wrigglet and take a knife, a saw and cut a small wrigglet into the sheeting, and then shove the flashing into there, and then tape over the top? Because I am a big fan of the fact that I think sealants will fail. But, it is okay if everything is layered and flashed so that it can drain out. The manufacturers are now saying that, . . . How many of you guys are comfortable putting on OSB, would be comfortable putting on OSB on a roof, and then no building paper, and shingle right on top of the OSB? Everybody okay with that? As long as you tape all of the joints and seams. They say, "What about a valley?" So, you have valley flashing running down the valley and you want me to tape the valley. Yeah, you can take a four inch tape and tape the valley. I said that I do not like that. Right? What is wrong with valley flashing? That is expensive, is it not? No. Why would you put valley flashing in and then probably do it, so that if you have such turbo product as really good seams, why would you put a layer of felt as a layer of forgiveness, and then let the layer underneath be really super turbo, and it would last longer? That would be awesome, would it not?

What we are trying to get into the marketplace, that sheeting is a little more expensive, so if we take the house wrap out of the equation, our product looks better. In terms of price. I said, "Well, okay. I guess you can do that." They have some pretty cool stuff that they did to show that product does not let water through the OSB, but I am really worried about the seams, joints, and connections. If the roof looks like this, how do you feel about tape? (Laugher) This would freak me out if you taped this. But, hey, it is doable, and it is acceptable and they can do it. So, I think that the manufacturers have to make sure that they are talking with the same nomenclature.

Some of these guys like to take out a couple of units, "Oh, yeah, a degree 80, it does not really matter for us." Or you can get rid of the Fahrenheit on the calculation and everything is okay. People like to remove units when it works for them. But, I do not think that you can remove units, can you? There are enough engineers in this room to, could throw you guys and people would say that is it amazing. It is a bunch of engineers. You cannot take off little parts of the equations. That is why I keep making them accountable for physics. Is that kind of what you asked? Anybody else?

Do you know that this town is remarkable well known for **microburs**? I will just bring that up. So there are no more questions, you guys?

MAN: There are plenty of questions.

MARK: I know, I hope so, but yes, I will be, right there.

(Man in audience speaking)

MARK: He asked how Canadian housing compares with the housing in the US. It is interesting. Our perception would be what? It is always better. According to the Canadians, what would they say? It used to be better. Yeah. They are saying that some of the housing in Canada, the Canadians have got kind of lazy, too. I am seeing Canadians do a beautiful job of vented rain screens. Houses in Montreal and Quebec, and seeing some just beautiful workmanship with vented rain screens and did an exceptional job of insulating. But, again, it has become a choice. They are sub-bidding a pretty large amount on money on research that. The NRC in Canada and the Canadian Merging Housing Corporation have one of the most beautiful research libraries you have ever seen. It is just filled with research that has been done over the last 30 years, in a library where you cannot get to it, unless you are a Canadian. Right? Canadians are phenomenally generous. If you go to CMHC website, just Google CMHC, Canadian Merging Housing Corporation. Some of the best data and information on commercial, residential, multi-family, fire, everything that you have seen. They have done a phenomenal amounts of tremendous research and it is available on their website. Most of it is free, and some of it you can download the entire report for like, $2 or something. But it is a tremendous place to find information. Part of the challenge has been in certain regions in Canada, we are seeing better construction stuff than we are in others. A lot of it has to do with inspections. In some areas where there is nobody looking, they will do whatever they can, and they do it in the name of price. I think in terms of true responsibility, the Canadians are doing, have done a pretty remarkable job.

Now the one I told you about, what is going on in England, that is because Canadian Merging Housing Corporation sent a really bright fellow, one of my great friends. His name is Oliver _____. Oliver _____ has now been put in charge of international relations from the Canadian Merging Housing Corporation. He has been all over the world, Russia, and he has been all over Europe. He has been in Korea. His son is in Korea right now, helping change the way houses are being built as an Adversary from Canada. He said that we are having almost more success converting other parts of the world to building better buildings than we are in our own backyard. Has that ever happened here? We are always, everywhere else, telling everybody else what to do, but here we are like, “Yeah, but we do not have to do that here.” Right? So that is interesting. Yes, sir.

You do not need a microphone, you are good.

MAN: I had a question. You are talking about all of this building physics and we have seen, in different places, in the States - Kansas, Florida, Louisiana, Mississippi, and the Caribbean. When you talk about building houses that would withstand 100 years, and take into account hurricanes, what is your approach on that?

MARK: Well, just do not live there. (Laughter) See, how easy that was?   I totally had that figured out, see it was a piece of cake. Can we build buildings in those marketplaces that will hold up remarkably well to adverse weather? You know when Hurricane Andrew went through Florida and just blew the place apart, the insurance companies went back and found out that nobody was nailing down the roof sheeting. Half of the staples missed the entire trusses, there were no hold downs on the exterior, and they are using staples instead of nails. So, they went back and the insurance industry and code industry in Florida changed everything and said, "You have to actually nail and you actually have to hit the rafters, and you have to use tie downs." The next hurricane that came through, they did not lose any roofs. Can we build buildings that are more respectful and sensitive to the markets that they are in? What is the technology and technics for keeping wind-driven degree from hurricanes, from blowing into houses? Costal regions, along the Gulf Coast, have to do what in terms of hurricanes? One hundred forty mile an hour winds, right? And they have to be free, at the least the coastal ones, above 140 have to be able to withstand the wind-driven degree. Now, the window manufacturers then had to come up and say, "You know if you do this,. . " You probably know this. Manufacturers had to be able to take a 2x4 shot out of a canon, add a window 35 miles an hour into the glass, and not go through. Are they able to do that? Of course, we have the technology to. . . I was at the Anderson Window Plant, and the engineers were doing rock, paper, scissors, to see who gets to pull and fire the canon. "Oh, you got to fire it yesterday!" You take a 2x4 and you fire it at a centerpiece of glass and you watch the 2x4 bounce off. You also have to fire another one at the rail at the window, if it is a double, the window sill has to make it. Somebody basically said one time, "Yeah, but in Florida they build a lot of CMU's." So if they use concrete masonry units on the first floor, because they think that is for termite protection, because cannot climb. So, they have a CMU, somebody said, "What if we fire a 2x4 at the same speed at a CMU?" So, they did that and what did the 2x4 do? Right through the CMU! Right? I just want to know, this is a tip. When you are in Florida in a hurricane, stand in front the windows. (Laughter) Just stand in front of the window and go like this, "Bring it on!" Let me just tell you, we have to take the capabilities, I think we have the technology. You could look at things like ICF's and other technologies that in certain marketplaces we could build more durable buildings.

The acts of God, as they say, incredible forces of nature, sometimes kick our butt. But, do you think we should ever really be living in New Orleans? (Laughter) It is eight feet before sea level.

(Someone in audience talking)

Here is the catch about New Orleans. New Orleans is a remarkable place. Do we have the understanding and technology to put dikes in where we know what the storm surges might be. Has anybody else in the world figured do that out? Europeans have dikes that will handle 72 a foot swell in the North Sea to protect Amsterdam. How long have they been working on that? Continuously. They say, "What is the potential for a hurricane in the North Atlantic to cause an ocean swell at what level? Let us build it just a little higher than that." What do they do in New Orleans? Let us add some more dirt to that little mound, right? We knew that the dikes were going to fail, we knew the pumps were old, and nobody invested in the technology. We now have spent tens of billions of dollars, then place is still a mess, and everybody knew it was going to happen. When are we going to change that approach? Can you live in New Orleans and have a properly installed dike to manage the weather and not flood that in a hurricane of the forced four, Category four? Do we know how to do that? Of course, we do. We choose not to. That is the catch. Either spend it now or we spend it later. To improve those dikes over the last 20 years, which we knew were a problem, would it have still been less money that we have been spending in New Orleans now, and all of the coastal regions? We would rather have first cost drive our decisions. Long term costs would have been far and way cheaper. What are the odds that a hurricane was going to strike New Orleans? (Laughter) Is there any proof that was maybe going to happen? It has been a rumor that there was not really much evidence, but they had heard that could happen. Right? That is ridiculous. It is embarrassing. I think we know how to do this. We have some of the finest engineers on the planet Earth and we choose not to do that, in the name of first cost. Anybody else?

MAN: I do not want to beat this cost issue to death, but it is an issue that is beating energy efficiency advocates to death because we do not have a sufficient data base to go out and do the proper messaging and make the proper arguments. Earlier, you suggested that everybody bombard B with emails and cost studies. My name is Harry Miserello, I am with ACEEE, I am in the roster here, and working with our sister organization, Building Code. Since this project, I am trying to compile some cost data, so look me up or look Mike DeWine up and send us your cost studies so that we can compile this stuff. Because, we just found out in the state of Ohio that it is going to cost the average house $15,000 to meet the 2009 IECC. Oh wait, that was last week's price! It is now $25,000 according to the Ohio Homebuilders Association, and this is after they rolled the code back to a less efficient level, below the 2006. We have a real hard, up hill fight, and I mean, some of it gets to the mandatory nature of building codes. Everybody prefers voluntary programs. The voluntary programs give you, at best, single digit penetration rates, and 95% or 97% of the houses are built the other way that you showed us in the slides and pictures. Anything, anybody in this room could do to do two things. The cost data, and secondly, provide sources of homebuilders that are willing to get up and speak to this, saying that we can do this. You know, the housing industry, you know, dropped about 48% in sales over this depression, or recession. The market for the 50% tax credit homes went down 6%. So that, efficiency is holding its own in the marketplace and we hear different stories that are energy efficiency is number 9 on the list of people, when people are looking for homes. We see other surveys that it is number 1. We have tog et at this and make the proper agreements to the decision makers, which in this case, are code officials. When they vote on this stuff.

MARK: Well, I agree with you and one of the recommendations I can make is to hire Bruce and send him to Ohio. Tenacious fellow. Is Mike DeWine here still? You know, what happened in Michigan? Is Michigan a problem? Oh my goodness! I was in Michigan, what a nightmare! They wanted to take their code back to 1982. They were saying, "That would be fine. Think of how many more people could buy houses." What an interesting experience that I have been in all of those states and watched that exchange. Is there enough data? Diane and I talked about this at dinner last night. Is there a need for more case study examples of incredibly successful projects that work? Is there a need for that? Can we fund that and get it to people and how many people have done it in this room? How many can say that they have data already that you know of or have access to, that looks at the performance of buildings and some cost data and has some numbers of performance? Anyone in this room? Raise your hand if you know of stuff. (Counting) So, what if we all combined that and did a much better job of disseminating that information around to those folks? When you get that data, ACEEE, what an amazing organization, is Bill Prindle still there? No. Is he? I like Bill, he is a nice guy. (Someone talking) Is that right? To take Bill's job, no kidding, he is amazing. I served on the board with him. If you think about the idea that more data and more information could be incredibly powerful, because that is what everybody is saying, "Give me the data." You are like, "What do you think of this? Here is four studies and here is four reports, here is nine builders that are doing this." If you do not know Vernon McCowen of Ideal Homes in Oklahoma, he is a phenomenal guide. If you want to bring in a builder who can absolutely blow you away, phenomenal communicator, an exceptional builder. Him and his partner are doing, they are the number builder in the state of Oklahoma. As far as his ability to communicate to the NHAB, he does a tremendous job. Ron Jones is currently trying to really push NHAB really, really hard on these energy issues, and so Ron is in Orcus Island, with Green Building Media. There is a lot of people, you would be surprised who are driving the best that they can the same bus that all of us could do a better job by having better information. Mike?

MIKE: Bruce, did you want to go first?

BRUCE: Yeah. I just have to take advantage of Mark being here, that to say that in Minnesota, and you talked about how important ventilation was. People have to breath in houses, we were followers in Minnesota. Don Stevens worked his tail off in Washington, got ventilation in. We have Vermont, we have several states now have mechanical ventilation. One of the things that we did, and Mark talked about this too, was how important it was to understand that as we build these houses tighter, we still have ventilation fans and we still have atmospheric vented appliances. It does not seem that people are kind of catching on to that. Let me just mention something that may give you an inclination to thinking that you ought to require maybe makeup air. We put makeup air in Minnesota's code and how furnaces have you seen since, how many houses have you seen with gas heated houses, that do not have sealed combustion? Would it be one?

MARK: Have you seen one? Have you seen a single one?

BRUCE: I never have seen one. Every house in Minnesota is 90% furnace. Every house. On the average, we are 35% better than the Energy Code House. Every house, minimum code. All you have to do, completely, not violating any federal super session of states required higher energy standards, because we did not require a higher energy standards. We said, "When you atmospheric vented appliance in, you are going to provide makeup air." They said, "Hey! We will take the easy way out."

MARK: The easy way out was sealed combustion. They had to put in a makeup air unit for atmospheric vented appliances, which cost them $900, when for $300 they could have sealed combustion; it was called Market 101. Right? Market Economics drives people's decisions, I think. Thank you, Bruce.

MIKE: A couple of things. First of all Harry, I think that the Herz industry, Resonant and the Hertz industry has plenty of cost data and plenty of cost analysis. Every home that is perforated has that economic run associated with it. Mark, this is a question for you and this a struggle that. . . I have heard this discussed, I think a lot of us in this room have a technical bent to us, and when we are trying to effect change, we are trying to make change occur, and that is what code is for many of us. It is change, and again, I am stealing my thunder from tomorrow, but change equals pain. It is constant in the universe, so change is scary, change is pain, and the fear factor is how we get numbers like $15,000, $25,0000 to go to the energy code, which are obscured, obviously. I think a lot of us on the technical side, kind of, we approach it, like, "I have really good numbers to prove my point." And there is an emotional argument that says, "I do not believe that. No, no, we cannot do that here. That does not work here, that is a case over." Let me tell you, where I am from, the "C" word is California. That is the bad word. California, that is the land of fruits and nuts, right? So, if something is from California, that is going to discredit us. If I can get something from North Carolina, or from Alabama, or something from another place like Georgia, then there is a little bit more validity to it. I definitely want to emphasis that I think there is a regional aspect to case studies that you should definitely be aware of. Frankly, your issues here in the Pacific Northwest are very different than my issues in a hot, humid climate. I think that is very important to consider.

The other thing is that I think we, as a technical group, have a tendency to want to say, "Oh, well you did not believe my 50 case studies, so I am going to get you some more. Here are some more tests, here is some more data, here is some more case studies to prove my point again, and look I improved the decimal point by a little bit more," but we are still battling an emotional resistence. So, how do we break that down?

MARK: That is the great challenge that we all have is it not? Are there not people that are the most, every major scientist in the world has said that there is a challenge going on with climate change, and we found out that the only people that are saying 'No, there is not one,' are hired by who? It is really clear as a bell. Clear as a bell. We know that, your utility, but it is as clear as a bell. There are people that are being hired to discredit the fact that there is probably global change of some type. Global change of some type. Now, people say, "Oh, good that is what I was looking for. A reason not to change." So, your point is pretty well taken, that we allow ourselves to do what is easy. When I am talking to builders in their sales areas, I talk about sales agents. Sales agents are probably our biggest disaster of all, to be honest with you. Realtors.

I just watched that whole experience. I do a bunch of secret shoppers with builders and in Sacramento I did six different builders in Sacramento. I went out to the job site, said, "I am looking for a house, non-contingent sale, I heard that you built some energy efficiency stuff. Tell me a little bit about those." "There are good." Really, I am okay. "So, tell me a little bit more about this." Of the six I went to, a couple of them I had to encourage them to have me fill out the card with my name and stuff on them. They could not even get that right. It was, "I want you to go look around and tell me what you think." After about two months, how many calls have I gotten? From people wanting to see if I am interested? Zero.

I did the same thing in San Antonio. I went to a builder down there, the builder said, "Would you secret shop for my product?" I walk in the door, there is two models, no one in the first model. I am kind of walking around, I go to the second model. I can hear some rustling of papers, somebody is moving something around; okay, there is a body here. This younger kid comes walking over. He said, "Oh, hi! You looking for a house?" "No, I was looking for the bathroom. The gas station is plugged up, I thought I would stop by and pee here." Right? Well, I think that is a stupid question, right? "Yeah, that is why I came, I had nothing better to do. I thought I would just cruise through a model home." Is there a chance that I am interested in something where I live now? Absolutely, of course. I said, "Well, I am from Canada and I am thinking about building, about moving to San Antonio, and about buying a house. I do not want a contingent sale or anything, but I heard that you guys build a pretty efficient home." "Yeah." "Do you guys, we use Low-E windows in Canada. Do you?" "I am pretty sure." I said, "Okay." He said, "If you have any other questions, I will be over in the other model, and stop on over, and you can go ahead and look around." Now, as a buyer, do I know where the bathroom is? It has a toilet in it. I look in and say, "There is the bathroom. Where is the bedroom?" It is the room with the bed, right? So, I walk around and kind of say, "Okay. T his is a house, right?" I walk out and the guy gives me this pile of papers, and it has a bunch of floor plans, reversed both directions with a pricing page. He said, "Oh by the way, there is an elementary school right up the street." Now, do I have any kids in elementary school? My kids are in college. Should he have asked me if I had kids in elementary school? If I have kids in college and I am looking for the elementary school, he should be concerned. (Laughter) Right? I am not getting any feedback here from this guy. I leave, of course, and the builder that hired me had me come the next morning to address sales staff and then, production.

I come in the next morning and this is what happened. I go in the morning and there is this breakfast and the realtors are coming in, and I am getting a cup of coffee at the table, and here is this kid that comes up. He walks up and says, "Hey, oh shit." Like that. (Laughter) He got it, like that. I said, "Jimmy, what is my name?" He said, "I do not remember." I said, "it was last night. You should have remembered me. I was a potential client that showed up wanting to buy a home from you, engaged you in this discussion, and you have no idea what my name is." It was great, he said, "Well, you are from Canada." I said, "Yeah, way to narrow it down. Kind of a big country, you know. You could have asked me what city I was from." So, you guys' biggest disconnect is from the builder and then, he says the consumer is not interested. I can prove. Because they do not ask for it. What is the gap in here? You know, somebody that is completely incompetent and incapable. Some of them are brilliant, I have met three. Some of them are really good. T here are some very good real estate folks that I have had the pleasure to work with, but if that is bad connection between the consumer and the builder, saying that this is what I want, and you watch that sales process, we are in trouble right there. How much effort is being spent on getting sales agents knowledgeable about energy efficient homes? Almost nothing. Right? Very little is being done for those guys, so I think as a whole, there is our interesting gap to buyers. Because when I do some sales training stuff, you know what I make them do? "Give me a feature and a benefit in a building and energy efficient house."

Vernon McCowen in Oklahoma? He makes their sales agents take somebody through and show the benefit and the feature. Yeah?

WOMAN: We know that you are passionate and I almost have a tear in my eye, but we have people that have to get on the post soon and we know how that went last year.

MARK: You said 45 minutes so,. . .

WOMAN: . . . with a couple of us. (Laughing)

MARK: Thank you, bye.

WOMAN: One more.

MARK: Okay, thank you Pam.

MAN: You showed the web trusses for the floor, what is your opinion about the insulated roof deck? As a way to get insulated?

MARK: Before what? I was being a smart ass. You said, for what? Roof deck?

(Someone talking in audience)

MARK: I am a little concerned about a couple of really quick things. I am a little concerned about us insulating a roof deck, taking out the ventilation provision, because I am concerned because I think that the shingles leak and I think that roofs leak. My little concern is that I would like to see, . . Tyvek has a product called attic wrap, if you have ever seen it. They have the trusses and you lay the attic wrap across it and you put a cap over each one of the rafters that creates a little space where you have a vented membrane, and then you put the roof deck on top. It is a vapor permeable, plus it lays over. It has a little sticky piece that is actually shown, you can get an airtight assembly. You can then insulate from the bottom side and cathedralize the insulation, giving some ventilation or forgiveness should the shingles leak. Insulation the attic space, if you chose to condition. So, conditioned attics can be a really good step, as long as we still follow the physics principles. What everyone wants to do is say, “Foam the roof deck and you are going to be fine, condition the attic, it is over.” I think that we are going to have to make sure the same principles apply.

So, I have a really nice boat trip. Thank you all very much for coming today.

(Clapping)