Date: April 30, 2015

Case: The Residential Standards Boilers Meeting

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U.S. DEPARTMENT OF ENERGY PUBLIC MEETING

THE RESIDENTIAL STANDARDS BOILERS MEETING

U.S. Department of Energy

Forrestal Building, Room 8E-089

1000 Independence Avenue, SW

Washington, DC 20585

9:14 a.m.

Thursday, April 30, 2015

Appearances for Department of Energy Meeting

Doug Brookman, Chair
John Cymbalsky, DOE
Eric Stas, DOE
Andrew Allen, Navigant
Catherine Rivest, Navigant
Adam Darlington, Navigant
Christopher Lau, Navigant
Caroline Davidson-Hood, Air-Conditioning, Heating, & Refrigeration Institute
Nicholas Mislak, Air-Conditioning, Heating & Refrigeration Institute
Amy Shepherd, Air-Conditioning, Heating & Refrigeration Institute
Aykut Yilmaz, Air-Conditioning, Heating & Refrigeration Institute
Frank Stanonik, Air-Conditioning, Heating & Refrigeration Institute
Don Farrell, Oilheat Manufacturers Association
Victor Franco, Lawrence Berkeley National Laboratory
Alex Lekov, Lawrence Berkeley National Laboratory

Roger Marran, Energy Kinetics

Joanna Mauer, Appliance Standards Awareness Project

Sarah A. Medepalli, ICF International

Gary Hainley, U.S. Boiler Company

Christine Hazelbaker, ACCA

Richard D. Murphy, American Gas Association

John A. Roda, Burnham Holdings

Steven J. Rosenstock, Edison Electric Institute

Paul Sohler, Crown Boiler Co.

Gregory J. Stunder, PGW

Cory Weiss, Fieldcontrols

Anurag Maheshwary, Department of Justice

P R O C E E D I N G S

MR. BROOKMAN: Good morning everyone. Welcome. So glad to see you here this morning. This is the Notice of Proposed Rulemaking Public Meeting on Energy Conservation Standards for Residential Boiler. Today is Thursday, April 30, 2015, here in the Forestal Building in Washington, D.C.

My name is Doug Brookman, Public Solutions, Baltimore. Nice to see you this morning. We're going to start with welcoming remarks from John Cymbalsky.

MR. CYMBALSKY: Thank you Doug. My name is John Cymbalsky. I'm the Program Manager for Appliance and Equipment Standards here at DOE. I'd like to welcome everyone here today for the public meeting for our proposal on residential boilers. Also, welcome all of those on the webinar. Hopefully, today we'll have good connection to the webinar and the audio.

We're in a room that we're generally not in for our meetings, so hopefully all with go smooth. If not, please, folks on the webinar just try to get in contact with us if things aren't going smoothly so we can try to rectify that, but DOE appreciates everyone's comments on this rule as we go along today. So, please don't be shy about raising any comments you have with the presentations here. Thank you.

MR. BROOKMAN: And just to be a little more specific, we're hoping that those of you joining us via the web that you can hear everything that's going on in the room. And some of you have representatives here in the room. If you could text them or communicate with them via email if you're having a hard time picking up the audio or the visual -- I think the audio is the one we're concerned about. The visual seems to be working well, but hopefully this will all come together the way it should.

All of you received a packet of information, I hope. On Slide Number 6, you can see an agenda as listed. Immediately following this agenda review and a few preliminary slides, there's an opportunity for summary remarks here at the outset, brief opening remarks from anyone who wishes to here at the outset.

Moving on from there, we will go through this packet of information and this content, starting with marketing and technology assessment and then screening analysis, and then engineering analysis, and proceeding markups analyses and energy use characterization.

We'll take a mid-morning break around about 10:30 or so. We'll proceed with life cycle costs and pay period analysis and then shipments, national impact analyses, RIA. We'll take lunch around about 12:30 or so, probably, and then proceeding or whenever we get there manufacture impact analysis, environmental impacts, indirect employment, and then at the end of the day today, whenever we arrive there, yet another opportunity for comment.

We want to make sure everybody gets the chance to say everything they need to say or want to say here during the course of this meeting.

Comments, questions on the agenda?

(No response.)

MR. BROOKMAN: Seeing none, I'd ask for your consideration. Please speak one at a time, if you would, here today. You can get used to turning these microphones and off. We're going to do introductions in a moment. You can get used to doing that. If you'd say your name for the record each time you speak. You don't need to say your organizational affiliation unless you wish to.

If you could keep the focus here and try and make your comments as succinct as possible, and please turn your cell phones on vibrate, on silent mode, if you would, so that we don't interrupt the meeting here. And those joining via the web, we certainly do welcome you. Hope you can participate fully in this meeting. If you'd turn your telephones on mute, and then you can raise your hand in the software provided. And if we're luckily -- this is a new room, as John Cymbalsky said, for us.

If we're lucky, we ought to be able to hear you in the room. The audio seems to be excellent so far. We'll see if the technology works to our advantage or not.

Questions and comments before we proceed with introductions?

(No response.)

MR. BROOKMAN: So, let's do that. The little green light gets illuminated, name and organizational affiliation. We'll just go around.

MR. SOHLER: Paul Sohler, Crown Boiler Company.

MR. MARRAN: Roger Marran, Energy Kinetics.

MR. FARRELL: Don Farrell, Oil Heat Manufacturers Association.

MS. HAZELBAKER: Christine Hazelbaker, Air Conditioning Contractors of America, or ACCA, the Indoor Environment and Energy Efficiency Association.

MR. ROSENSTOCK: Steve Rosenstock, Edison Electric Institute.

MR. STANONIK: Frank Stanonik, Air Conditioning, Heating, Refrigeration Institute.

MR. MURPHY: Rick Murphy, American Gas Association.

MS. MEDEPALLI: Sarah Medepalli, ICF International, representing EPA.

MR. RODA: John Roda with Burnham Holdings. We're the parent company of Crown Boiler, U.S. Boiler, and New Yorker Boiler.

MR. HAINLEY: Gary Hainley, U.S. Boiler Company.

MS. MAUER: Joanna Mauer, Appliance Standards Awareness Project.

MR. LEKOV: Alex Lekov, Lawrence Berkeley National Laboratory.

MR. FRANCO: Victor Franco, Lawrence Berkeley National Laboratory.

MS. RIVEST: Catherine Rivest, Navigant Consulting.

MR. DARLINGTON: Adam Darlington, Navigant.

MR. STAS: Eric Stas, DOE General Counsel's Office.

MR. CYMBALSKY: John Cymbalsky, DOE.

MR. STUNDER: Greg Stunder, Philadelphia Gas Works.

MR. LAU: Chris Lau, Navigant.

MR. ALLEN: Andrew Allen, Navigant.

MR. MAHESHWARY: Anurag Maheshwary, Department of Justice.

MR. YILMUZ: Aykut Yilmuz, AHRI.

MR. MISLAK: Nicholas Mislak, AHRI.

MS. DAVIDSON-HOOD: Caroline Davidson-Hood, AHRI.

MR. WEISS: Cory Weiss, Field Controls.

MR. BROOKMAN: Okay. Great. Thanks to all of you. Welcome again. Glad to see you this morning.

There are a few preliminary slides that John Cymbalsky is going to read through. Okay. Great. Thanks to all of you. Welcome again. Glad to see you this morning.

There are a few preliminary slides that John Cymbalsky is going to read through.

MR. CYMBALSKY: Okay, so again, welcome everyone to the meeting and welcome to those on the web. The slide just reiterates that we want to make these meetings as accessible as possible, not only in person but obviously around the country and around the world on the webcast, so please feel free to speak up. Even though you're not in the room, you are virtually here and we appreciate your attendance.

So, the purpose of today's meeting is to present the Proposal for Residential Boilers. We're going to go through the slide deck and detail our analysis, both on the engineer side and on the economic side.

As we go through this, please feel free to chime in with comments and questions. You will also see little comment boxes as we go along, and you can see one on this slide on the bottom. That's what a comment box looks like, and we will point out specific items of interest to DOE, not that all of them aren't important, but there are some that we find we need more information if we can get it. So, at this time, we'll take opening remarks from anyone who might have one.

MR. BROOKMAN: Summary statements here at the outset. Joanna?

MS. MAUER: We're supportive of the proposed standards that would result in significant national energy savings and savings for consumers, and there are a large number of models available today at the proposed AFUE levels.

We do note that there is a large additional opportunity for energy savings at condensing levels for hot water boilers. DOE estimates that national energy savings at condensing levels would be more than five times larger than the savings at the proposed standard levels and so we encourage DOE to continue to consider condensing levels for hot water boilers.

MR. BROOKMAN: Thank you. We're going to have to get close to these microphones as we speak. Steve Rosenstock.

MR. ROSENSTOCK: Steve Rosenstock, Edison Electric Institute.

I just wanted to thank the Department in this case for doing a rule that is fuel and market neutral by looking at all different types of boilers that are competing in the marketplace. Looking at them and deciding on standards that are going to affect at the same time. I believe that whatever the final result is, by doing this process, I believe it will be better for overall in terms of the final result. Thank you.

MR. BROOKMAN: Thank you. Additional comments here at the outset? Opening remarks? Nothing additional?

(No response.)

MR. BROOKMAN: Okay, we're going to press on with the content.

MR. CYMBALSKY: This is John Cymbalsky, DOE, again.

I did receive from our staff a request to do a presentation at today's meeting. Does that still hold? I think it was maybe Crown Boiler?

MR. STUNDER: It wasn't Crown.

MR. HAILEY: Burnham Holdings Group had an opening statement not a presentation.

MR. CYMBALSKY: Okay. I think now would be your time before we move on.

MR. HAINLEY: So, I'm Gary Hainley with U.S. Boiler Company and I'm also speaking on behalf of the Burnham Holdings Group of Residential Boiler

Companies, which is U.S. Boiler, Crown, and New Yorker.

We thank the Department for allowing us to make oral comments. One of the concerns we have is the simultaneous promulgation of the test procedure as well as the rulemaking. And just find that it's challenging for us to make final comments on the proposed rule until we know how we're actually going to be measured.

We feel that the test procedure will reduce existing products by 1 to 2 percent AFUE points and we really need to get a handle on that before we can fully comment on this rulemaking. Additionally, we feel that the biggest concern for us is the 85 percent standard for gas-fired hot water boilers, that, in essence, we run the risk of eliminating chimney venting, that at 85 percent the flue gas temperatures are reduced to such a extent that many of the chimneys in place today just won't be able to be used.

And with 85 as the federal minimum, consumers no longer have the choice of using an 82, 83 percent product as they do today and it would force them either into repairing an existing product at lower efficiency and not upgrading or going to a much more expensive retrofit to be able to get that newer product.

MR. BROOKMAN: Thank you Gary. Additional comments, perhaps final comments here before we proceed with the content.

(No response.)

MR. BROOKMAN: Okay, proceed.

MR. CYMBALSKY: Okay, John Cymbalsky again.

(Slide.)

MR. CYMBALSKY: So, this slide just shows you what the request for comment boxes look like, and they'll be sprinkled throughout the presentation today.

As noted on the slide, the deadline for submitting comments is June 1, 2015. Doug already went through the agenda, and so we're going to dive right in with the regulatory authority. So, several pieces of legislation that became --

MR. BROOKMAN: We have a quick question or comment.

MR. RODA: Yes, a question as to the June 1 deadline. I understand a request has been made to extend that. Is that pending right now, a decision on that?

MR. CYMBALSKY: I personally have not received a request for extension.

MR. BROOKMAN: Please say your name.

MR. FARRELL: This is Don Farrell from the Oil Heat Manufacturers Association. We did send a request for an extension on the 27th, so it was very recently. Basically, the thought is that with -- it's just too big of an issue for us to properly comment on in that short time period. We request an extension to at least 120 days so that we can properly digest the 900-page technical document, the changing of the testing procedure, along with changing the efficiency ratings.

In order for us to be able to give a proper, thought out, digestible response, we feel that the June 1 deadline is just way too short.

MR. CYMBALSKY: Okay. Thank you. So, if you don't mind emailing that to me personally so I have it.

MR. FARRELL: Okay.

MR. CYMBALSKY: I'm fairly certain it didn't come to my inbox.

MR. BROOKMAN: Frank Stanonik.

MR. STANONIK: Frank Stanonik, AHRI.

Yes, we submitted a request for extension for an additional 60 days, and I directed it to the people identified in the NOPR, so it went to Eric and Ron Majet. I'll be glad to send you a copy of it.

MR. CYMBALSKY: Okay. Yes, unfortunately, Ron's fairly ill recently, so that could fall through the cracks; but if you could email and the docket as well that would be very helpful.

MR. STANONIK: Okay.

MR. BROOKMAN: Thanks for that clarification. Now, we're going to proceed with the content.

MR. CYMBALSKY: Okay, so we're going to start off with our regulatory authority. So, there's three particular pieces of legislation that are applicable here. So, there's EPCA of 1975, NAECA of 1987, and then EISA of 2007. Each one of these set different requirements for DOE in order to go forward with standards for boilers.

(Slide.)

MR. CYMBALSKY: So, NAECA established the initial standards for boilers, and you can see the cite to the U.S. Code there. DOE published a final rule in November of 2007. And then EISA in 2007 further revised the AFUE requirements and also set several design requirements for each product class.

So, for gas-fired hot water, oil-fired hot water, and electric hot water boilers manufactured after September 1, 2012, must have an automatic means for adjusting the water temperature and also disallowed the use of constant burning pilot lights in gas-fired hot water and gas-fired steam boilers manufactured after the same date.

(Slide.)

MR. CYMBALSKY: So, this table here just gives a summary of what the AFUE requirements and the design requirements are for the five product classes shown here. I will not read through them. I'm fairly certain most people are familiar with what the requirements are at this stage.

(Slide.)

MR. CYMBALSKY: The next slide shows the criteria for selecting standards levels. So, we have what we call the EPCA seven factors, which are listed here. And so for each one of those seven factors DOE does some rigorous analysis around each one of those factors to determine how to move forward with its proposed standard level. Today we will walk through each of these. I won't read them now, but we will go through them one-by-one.

(Slide.)

MR. CYMBALSKY: The next slide shows where our schedule is today. I understand we have a request for comment extension, and so that may not be factored into what you're seeing here today. So, once we get all those comment extensions filed and thought about, we will certainly let the stakeholders know what the decision is from the Department and we will adjust the schedule accordingly; but you could see the different milestones here.

So, at this point, we project the compliance date to whatever standard might become final to be December 2020, and that's when manufacturers would be required to meet any standard that DOE goes final with.

(Slide.)

MR. CYMBALSKY: And then here is our flow chart where we sit today. So, you could see the four chevrons. We're at the NOPR stage. Once we have all the public comments, we will proceed to the final rule stage where DOE will let stakeholders know what its final decision is.

And then at this point, we're going to turn it over to the market and technology assessment and pass it over to Catherine Rivest of Navigant.

MR. BROOKMAN: Question, please. Say your name.

MR. MURPHY: Rick Murphy.

John, quick question on the request for extensions, are those posted to the docket folder for the rulemaking.

MR. CYMBALSKY: They will be if they're not already, yes. I just need to gather them all. I'm sorry I didn't get them personally, but we will make sure they're in there.

MR. MURPHY: Thank you.

MR. BROOKMAN: Catherine Rivest.

MS. RIVEST: Thank you, John. I'm Catherine Rivest of Navigant Consulting, and I'll be going over the market and technology assessment, the screening analysis, and the engineering analysis.

(Slide.)

MS. RIVEST: So, the purpose of the market and technology assessment is to pull together all of the information needed to structure the engineering analysis so we can build representative cost curves. So, the type of information DOE is interested in answering our questions that include what types of residential boilers are being sold, in what quantities are they being sold, at which efficiencies are they being sold, what technologies are included in them, who manufactures them, and all of this information is used to inform the engineering analysis.

(Slide.)

MS. RIVEST: So, as you can see, the Department breaks up residential boilers into six different product classes on the basis of both fuel type as well as heating median. And one thing to note on this slide is that DOE did not analyze electric boilers for active mode standards, only standby and off mode standards.

(Slide.)

MS. RIVEST: So, looking at the relative sales of the different product classes, you'll see that gas-fired hot water boilers are accountable for the majority of the shipments, along with oil-fired hot water boilers, so DOE focused its analysis on the hot water product classes. And depending upon the product classes as well as the efficiency levels, residential boilers could be made up of a variety of different heat exchanger materials.

(Slide.)

MS. RIVEST: So, this figure here shows

the distribution of AFUE levels among gas-fired hot water boilers. And so this distribution is useful to DOE in the engineering analysis where there is a selection of efficiency levels to analyze.

So, as you can see, the distribution is broken out into two different segments, with the left being non-condensing boilers and the right being condensing boilers. And you'll notice that the majority of non-condensing boilers are made up of cast iron with some copper and some steel, while condensing boilers are typically made with a more corrosive-resistant heat exchanger, such as stainless steel or aluminum.

So, gas-fired steam boilers tend to have a much narrower band of efficiencies from 81 to 83 AFUE and are generally made up of cast iron heat exchangers. And so, for oil-fired hot water boilers the range is much larger with the baseline coming in at 84 and the max on the market at 93 AFUE, and they're primarily comprised of cast iron and steel in the non-condensing efficiency ranges. And oil-fired steam goes from 82 to 86 AFUE, with the majority of models coming in at 84 AFUE and being comprised of cast iron.

(Slide.)

MS. RIVEST: So, in the technology assessment, DOE developed a list of technology options that could be used to improve residential boiler efficiency as measured by the test procedure. So, the two tables here list the technology options that could be used to improve AFUE as well as standby and off mode energy consumption. And one thing to note is that this list includes all of the technology options that could be used for every product class and they're not all relevant to every product class.

And another thing to note is that this list includes technologies that are incorporated in the baseline, so DOE accounted for that.

(Slide.)

MS. RIVEST: And so the purpose of the screening analysis is to screen out technologies that won't be used in the engineering analysis. And DOE does this by looking at every technology option and screening it from the criteria to see if it's technologically feasible, if it's practicable to manufacture, install, and service, and if it has any adverse impacts on the product utility or impacts on health and safety.

So, in the screening analysis, DOE screened out three technology options on the basis of potential impacts to product utility, and those were pulse combustion, burner de-rating, as well as control relay to depower VPM motors.

(Slide.)

MS. RIVEST: So, moving on to the engineering analysis.

MR. BROOKMAN: Yes?

MR. ROSENSTOCK: Hi, Steven Rosenstock.

When you say could reduce a customer utility is that because some of these technologies have reduced the utility in the marketplace or -- again, maybe it's in the technical support document -- when you say could reduce, does it mean that in certain cases that it has and that's why it's too much of a risk to do that for a standard?

MS. RIVEST: It sort of depends on the

technology, but it could be seen as producing product utility. Sorry.

MR. DARLINGTON: So, Steve, I think the customer utility is a little bit subject, depending on the customer, right? So, I think that this is just saying that you know -- so, for instance, a pulse combustion system you know it might be louder. It might be you know less reliable. Depending on the consumer, that may or may not be a big deal, Burner B rating you're going to get a little bit less heat output when you temper your burner down. So, depending on that consumer's needs, it would reduce the utility if they need the full heat output, right? So, I guess that's why we said could reduce consumer utility. But yes, I mean they presumably would in certain instances, right, so that's why they were screened out?

MR. ROSENSTOCK: Thank you.

MR. BROOKMAN: Frank Stanonik.

MR. STANONIK: Frank Stanonik, AHRI.

Yes, before we get off or too far away from this, I understand you looked at distribution of listings by efficiency and made the point before that's really not the distribution of what gets shipped and we will try and provide some information that can better characterize what actually is rolling out people's doors as opposed to what gets listed.

MS. RIVEST: That would be very helpful. Thank you.

MR. BROOKMAN: Additional comments here before we move on to the engineering analysis?

(No response.)

MR. BROOKMAN: Okay.

(Slide.)

MS. RIVEST: So, the purpose of the engineering analysis is to see how manufacturer costs and selling price changes with increased efficiency. And so for the active-mode efficiency analysis DOE used an efficiency level approach where DOE selected efficiency levels and to determine their manufacturer production costs at those levels.

For the standby and off mode analysis, DOE used a design option approach and DOE relied on a variety of sources of information in the engineering analysis, so this included product tear downs, manufacturer interviews, product testing, product literature as well as product databases.

(Slide.)

MS. RIVEST: And this slide is just meant to provide a general overview of the steps in the engineering analysis, starting from the information that's fed in from the market and technology assessment to the selection of efficiency levels and the selection of units for tear down up until the determination of the industry average manufacturer production cost. And we'll go through each of these in the coming slides.

(Slide.)

MS. RIVEST: So, as you'll see from the table, DOE performed a full tear-down analysis for those product classes with the highest percentage of shipments, and this consisted of many tear downs across a range of efficiency levels. And DOE used an alternate analysis for lower shipment product classes, which relied on a smaller number of tear downs as well as information obtained from similar product classes and product literature.

(Slide.)

MS. RIVEST: So, discussing the baseline units, so a typical baseline unit is a unit that just meets the federal minimum efficiency standard and this table lists the baseline characteristics of the different product classes that were analyzed for active mode efficiency standards.

So, you'll see some common characteristics include cast iron sectional boilers, and the representative input capacity for gas-fired products was determined to be 100,000 BTUs per hour and that of oil was determined to be 140,000 BTUs per hour.

(Slide.)

MS. RIVEST: So, the first step of the engineering analysis is the selection of AFUE levels. And between the baseline and -- DOE also selected the max tech AFUE levels, which is the maximum efficient models on the market.

And in between those two levels, DOE selected intermediate efficiency levels where the majority of products were determined to be as well as anywhere there was a major change in technology. And so this slide just shows all of the efficiency levels that were analyzed in the active mode AFUE standards analysis.

MR. BROOKMAN: Yes, question? John, microphone, please and say your name.

MR. RODER: Catherine, I'm relatively new to this. Can you define a term for me? What do you mean by full tear-down analysis? I know that takes you back a slide or two.

MS. RIVEST: Sure. So, a full tear-down analysis is when DOE completely dissembles a unit and catalogs each and every part according to its material, the weight, and the processes used and then creates a bill of material, which is ultimately determined -- is ultimately used to determine the manufacturer production costs, the estimated manufacturer production cost.

MR. RODER: Okay. Thank you.

MR. BROOKMAN: Yes, please. Rick.

MR. MURPHY: Rick Murphy.

Just a process question, is this work --

was this work done prior to the Notice of Data of Availability that was issued last year or after or both?

MS. RIVEST: Both. It built upon the information that was disclosed in the Notice of Data Availability.

MR. MURPHY: Thank you.

MS. RIVEST: So, DOE selected units for tear downs spanning all efficiency levels, and DOE also chose products for tear down from multiple manufacturers in order to account for different fabrication techniques that may have been used. And so DOE used three different practices in the engineering analysis to come up with the cost efficiency curves.

So, this included physical tear downs where DOE dissembles the units into its component parts, a process called catalog tear downs, which is similar to physical tear downs, which DOE estimates the difference between a unit that has had a physical tear down and another unit that is very similar. So, an example of this might be the addition of a heat exchanger to a model that has been torn down.

And DOE also used an alternate analysis for the steam product classes, so rather than conducting tear downs at each efficiency level for the steam product class; DOE relied on information obtained from the hot water boiler product classes along with product literature information.

MR. BROOKMAN: Yes, Frank Stanonik.

MR. STANONIK: Frank Stanonik, for HRI.

So, I guess not specific to the tear down, but I think maybe this is the place to ask the question, in the case of residential boilers you really have a wider range of inputs available compared to like furnaces. I mean you know the definition of residential boilers stops at, what, just under 300,000 BTUs per hour. And so the question would be, so yeah, you've tear down baseline units and that's typical. It's understandable, but I guess I'm curious as to is there at some point where you look at trying to, in this case, extrapolate that -- actually go both ways, I guess, that tear down information to some of the let's say larger input boilers that are still out there and maybe even some of the smaller ones?

MS. RIVEST: So, we hadn't seen the efficiency really varied based off the size, the capacity, and so, no, we did not extrapolate.

MR. STANONIK: Frank Stanonik.

MS. RIVEST: Well, directly in the engineering analysis.

MR. STANONIK: Yes, I guess my concern is, and I certainly will talk to our members about it, but my concern is that maybe the cost becomes a bit different when you're looking -- again, you tore down the baseline. That's logical. That's appropriate, but I'm starting to wonder because they're still offering units with higher inputs and again, I will probably say it more than once, we're not talking about the big market of furnaces. We're talking about a relatively small market of residential boilers, so the issue of what might be the manufacturing cost for a let's say 250,000 BTU boiler may not just be a simple linear scale.

MR. BROOKMAN: Gary.

MR. HAINLEY: Gary Hainley, U.S. Boiler.

Frank's correct in that our cost structure is going to change as we get to the larger boilers. The lower boiler, the smaller boilers we manufacture in higher volume, but once we start going above that our cost to manufacture will be different because of size of the parts and also just the volume. We don't have the economies of scale to hard tool some of the parts that we may hard tool for smaller boiler sizes. That's a good point, Frank.

MR. BROOKMAN: Okay. Thank you.

(Slide.)

MS. RIVEST: So, this slide provides an overview of the active mode engineering analysis of each specific AFUE level, and AFUE levels highlighted in green indicate that one or more tear downs were conducted at that efficiency level. And those highlighted in purple indicate that those results were obtained through linear interpolation. And as noted in the previous slide, a few of the efficiency levels in the steam product classes were determined using the alternate methodology, which relied on information, obtained from the hot water product classes.

(Slide.)

MS. RIVEST: So, after developing the manufacturer production costs for each unit that was torn down, the next step is to aggregate the individual results into an industry cost efficiency relationship. And so this is the industry average cost efficiency relationship for gas-fired hot water boilers. And what's primarily driving the increase in costs in the non-condensing level is an increase in heat exchanger service area and the jump at 90 is due to the need for condensing, condensing heat exchanger.

So, the cost associated with gas-fired steam is largely driven by, again, a need for an increase in heat exchanger surface area. And again, in the non-condensing AFUE levels the cost is driven by an increase in surface area, while for the 91 AFUE point that's caused by a need for an increased heat exchanger area as well as the need for a secondary heat exchanger. And the cost for oil-fired steam are due to a need for an increase in heat exchangers surface area, for the large part.

MR. BROOKMAN: Frank Stanonik.

MR. STANONIK: Frank Stanonik, AHRI.

If you could actually step back, Slide 33. Okay, I guess I just want to make sure I'm understanding what I see here. So, the first bullet says you created cost efficiency curves for each major manufacturer, and then we have the little I'll say simulated pairs down there on the left. And the note says "Stylized graphics not based on actual data." So, okay, I'm reading the first one that you talked to some manufacturers and came up with rough approximations; is that an incorrect understanding on the first bullet there?

MS. RIVEST: That we came up with rough approximation for?

MR. STANONIK: Well, it says, "DOE created cost efficiency curves for each major manufacturer." I guess which major manufacturer? Are we talking about a general manufacturer of hot water boiler or a general manufacturer ^^^^ something's not tracking for me. I'm sorry.

MR. DARLINGTON: This is Adam from Navigant.

So, what the first bullet is trying to say is that we did tear downs looking at mainly the major manufacturers. So, for each major manufacturer we were looking at their units specifically. So, say we had Manufacturer A or Manufacturer Number 1 in this little simulated graphic here, so we had multiple points for that manufacturer.

We would look at what does it cost for that manufacturer to go from 82 to 84 to 95 or you know whatever the efficiency levels were that we were looking at and then we would have a cost efficiency curve for that specific manufacturer. We would have it for Manufacturer 2 and Manufacturer 3, look at them all separately to see what each individual manufacturer what it cost them to increase efficiency and then we would merge those together to create sort of an industry weighted average for increasing the efficiency.

MR. STANONIK: Okay, it was based on the

tear down stuff. I missed that. Okay. Thanks.

(Slide.)

MS. RIVEST: So, the non-condensing boilers may come equipped with inducer fans; however, inducer fans were not show in the graphics that we just saw and the manufacturer production cost efficiency curves shown in the preceding slide did not include the cost of an inducer fan. DOE did estimate the cost of an inducer fan between a boiler with natural draft and the same model with induced draft, and it was found to be $94. And this cost adder is included in the downstream analysis based on a percentage of models that would be expected to need induced draft at a given efficiency level.

MR. BROOKMAN: Frank.

MR. STANONIK: Frank Stanonik, AHRI.

Catherine, can you tell us what that assumed percentage was; do you know offhand?

MR. DARLINGTON: It's in a later slide.

MR. STONONIK: Okay. All right, well then I'll wait.

MS. RIVEST: So, DOE is seeking comments.

MR. BROOKMAN: So, a fair amount of content in those engineering analysis slide. Comments here? Frank Stanonik.

MR. STANONIK: Frank Stanonik, AHRI.

I mean I'll wait, but I'll also make the comment that at the level that DOE's proposing we think because of the manufacturer's need to make sure that products will be properly and safely installed in the field and trying to address what is the variety of installations we think that that level will, in fact, probably drive a majority of products to have some kind of draft inducers or some additional mechanical component added to the boiler, and so we think there's a real issue there.

MR. BROOKMAN: Yes, Rick.

MR. MURPHY: Rick Murphy, AGA.

I'm trying to understand what actually happened between the point in time where the Notice of Data Availability came out that indicated that there was not a justification for raising the efficiency levels and where we are today. So, in the engineering analysis, can you share with us some of the additional engineering analysis work that was done after the Notice of Data Availability and what prompted that?

MS. RIVEST: So, in terms of the engineering analysis, several more tear downs were performed for the cost efficiency curve side.

MR. MURPHY: I'm a little confused by the note -- your statement that it showed that it was -- the NODA didn't do anything of the sort.

MR. DARLINGTON: I thought in the NODA it had identified that based upon the preliminary analysis that DOE did not see a justification for increasing the statement.

MR. MURPHY: That statement was never made.

MS. RIVEST: I think the statement that was made is that DOE was not advocating for a specific efficiency level in the NODA. It was just providing information without giving a stance.

MR. BROOKMAN: Yes, please, Gary.

MR. HAINLEY: Gary Hainley, U.S. Boiler.

To the comment about standards above 82

percent, we're concerned -- and again, I think Frank commented that we feel that at 85 percent nearly all of the product will need to go to an inducted draft product, likely sidewall, because the chimneys just won't work in a large extent of the installations at 85 percent because of reduced flue gas temperatures and reduced buoyancy, that you'd need some mechanical means.

Our concern with that, and we're working with customers now to try to understand the restrictions that they have in sidewall venting in high density urban areas. Historic areas don't allow sidewall venting in some situations. There's some situations in metro New York, Philadelphia where sidewall venting is not practical and not cost effective. So, we're working with customers to provide more comment on that and more specifics; but we are aware of situations where a standard level at 85 percent will essentially drive some customers to just repair existing product. They're not going to be able to afford to do the significant retrofits to get to that level.

MR. BROOKMAN: Thanks. Additional thoughts, comments here? Yes, Roger.

MR. MARRAN: Roger Marran, Energy Kinetics.

To add on to Gary's point, I think, one of the things that we've had is on Slide 29 we noted max tech for a different type of technology and modality. And there's certainly a max tech for natural and atmospheric draft as well as condensing technology and I think it's important to recognize that how the max tech impacts the market from the standpoint of what products can be produced and serve that market as we look forward.

So, if there's certain adjustments to AUE where you can squeeze that market it may have a dramatic impact towards what can be served and how you can work with those particular products.

MR. BROOKMAN: Okay. Thank you. Yes, please, Paul.

MR. SOHLER: Paul Sohler.

Can you maybe elaborate a little bit on the -- you know one of the issues that goes into screening analysis is impact on health and safety. I'm wondering if you could elaborate a little bit on exactly how you go about applying that standard.

MS. RIVEST: So, if the technology is shown to have any impacts on health and safety, then that's something that's considered. Although if it's something that might have an impact on health and safety, but if it just needs a safety measure in order to prevent the impact ^^^^ from having an impact, then it would not be screened out.

MR. SOHLER: Is there some consideration on the probability that you know a given technology -- you know if it's a technology that will, in a perfect world, be safe, but let's say in practice it increases the odds of a safety issue; is that looked at?

MR. DARLINGTON: Let me answer this one. More pointed, it sounds like you're asking whether or not the installers, for example, will be able to install a condensing technology correctly?

MR. SOHLER: Not whether they'll be able to, but is it really going to happen in a reasonable percentage of cases?

MR. DARLINGTON: Right. And I think we have someone from ACCA here. Maybe they want to comment on the installer issue, but the condensing technology has been around for a while. It's installed safely, as far as I know most -- all the time, but maybe the ACCA person can comment as to how the installers go about making sure they install the product safely.

MR. BROOKMAN: Christine, you want to comment?

MS. HAZELBAKER: Not at this time.

MR. BROOKMAN: Not at this time. Paul, keep going.

MR. SOHLER: Yes, I guess, my concern is basically just you know this issue that I think several people have alluded to about putting 85 percent AFUE boilers into you know chimneys -- you know atmospheric boilers it's not that that may not be technically possible to do. The reality is that in a lot of cases when you look at the skill set of the people who are installing this type of equipment you know inability to size equipment properly you know and just you know the condition of a lot of chimneys that if that level is kind of driven it's -- you're basically reducing the margin of safety that you have you know by moving the level up to that point for things like chimneys that are a little undersized, maybe the liner is not in real good shape, maybe it does need to be relined and there's a water heater there and now the liner is smaller and you know like I said it's --

MR. DARLINGTON: So, we account for all those costs, and you'll see that later, that we do assume that when this replacement happens that all of those things have to happen to install that technology, so yes.

MR. STUNDER: So, I guess what he's getting at ^^^^ Greg Stunder from PSW is there can be certain situations where -- and how does it factor into your analysis where it wouldn't be properly installed and that could impact on safety. Did I state it correctly?

MR. STOHLER: That's exactly what I'm

trying to drive at, yes.

MR. DARLINGTON: I mean we assume that the installers know how to install the equipment.

MR. STOHLER: And I guess I would go on the record and say I don't think that assumption is valid, put bluntly, in a lot of cases, not all.

MR. STAS: Eric Stas.

Are you aware of any data to document the problem you think might be out there because that would be helpful for the record if you do.

MR. STOHLER: I think that you know there's plenty of incidents that involve chimneys that are you know not -- that had problems that resulted in flue products spilling into buildings. I mean as far as getting -- I might direct you to CPSC possibly may have some data. We might be able to provide some as part of our written comments. Obviously, a lot of it's antidotal, but you know it's definitely an issue. It's a big issue.

MR. BROOKMAN: Christine, you want to comment here?

MS. HAZELBAKER: Christine Hazelbaker.

I just reached out to one of my contractors and we'll get back with a comment, but I just want to check with the field first.

MR. BROOKMAN: Thanks very much. John, please.

MR. RODER: John Roder, Burnham Holdings.

The issue of carbon monoxide is always front and center for us. And you have a situation where you're creating -- where you're asking a contractor to install a boiler that's 85 percent efficient into a chimney that's inadequate. You are creating a risk there.

In an ideal world, they'd say, yes, we've got to line this. Yes, it has to be so big; but the reality is in the urban markets where these are sold there's not rigorous inspection programs by most municipalities. They're installed and then it's left to the manufacturer to try to deal with the problem that the installer created who may or may not be around after it's been installed.

So, I think to Paul's point it's extremely troubling for us to think about, oh, this is going to assume that the contractor base will all be qualified and recognize these issues that we find out sometimes in very serious situations.

MR. BROOKMAN: Okay. Frank Stanonik.

MR. STANONIK: As far as Issue 2 there, our position is -- okay, we certainly support DOE's decision to not go to a condensing level, but we have very serious concerns about going to 85, which is kind of we would say mex tech, not max tech, not in condensing.

I think you're hearing some of those concerns, but I think -- I just want to point out something that I will say underscores the difference and why we have a heightened level of concern about difficulty of installing these products so that you'll have a properly operating venting system and a safely operating boiler.

And this is from the 2009 EIA housing characteristics, okay. And so this is simply by their estimate number of homes -- and I'm just going to use natural gas -- that uses either a natural gas furnace or a boiler, okay. "Prior to 1950, 50 percent of all homes -- 2009 data, okay -- but 50 percent of all homes that had a boiler were built before 1950. Only 12 percent of homes that had a furnace were built between 1950." Okay.

Now, take it one step further, "Only about 5 percent of the homes that have furnaces have two or more housing units. Almost 50 percent of the homes that have a gas boiler have two or more housing units." Okay. So, what are we talking about? We're talking about older homes ^^^^ and again, you look where boilers are installed. We're talking about older homes probably in major urban areas that were -- you know my best example is one I always think about, and you have them in D.C. and in Baltimore, row houses you know, or they might be multi-families, but basically there is not -- certainly not four walls that you might have access to vent the product.

You have the roof, yes, but some of these if you start talking about trying to vent them through the roof with an 85 percent product or an 86 oil, you're asking for trouble and we know that. And so I think that's why we're going -- we are more concerned about an 85 percent level, which is non-condensing, which nominally is atmospheric vented, but to install base of where these boilers are, and this is replacement business. Where they are in the venting systems they're using now, okay, because we're talking about half the homes were built before 1950

You know the manufacturers that's their market and they have to deal with that. And so this level at 85 is, for us, just too far as a minimum.

MR. CYMBALSKY: This is John from DOE.

So, I'm just looking at Slide 17. So, this is the gas-fired hot water market disposition from the AHRI directory. So, I'm just looking at the disposition of the model. So, we have at the 85 AFUE level you have -- it looks like 80 models. Now, I know we keep talking about 85. Is what you described the problem at 84 as well, or no?

MR. STANONIK: Frank Stanonik, AHRI.

Well, the magnitude certainly goes downward. You know whether it becomes more of a manageable issue or not that's something we're still looking at.

MR. CYMBALSKY: So we have, just looking at this chart, we have about 180 models at 82 and 83 and we have 140 models at 84 or 85 -- well, actually if you add 86, go about 150. So, to me the market looks a 60/40 split below 84 and 84 and above. That seems to tell me that lots of people are installing 84 and above.

So, the question then back to you guys is if that's, in fact, true then if there was a problem installing these I would assume it would make national headlines. I hadn't seen it, but please provide the data if it has.

And then secondly, it seems to me that if, in fact, Frank's statistics bear out that all these things go into older homes, then 40 percent of them are doing it already. So, I guess the models don't bear out the logic that you've -- and I'm not disagreeing. The statistics are what they are, so I agree wit them, but the market data tells me that this is happening at a fairly high rate already.

MR. BROOKMAN: Paul, go ahead.

MR. SOHLER: Paul Sohler.

You know as far as the 85 percent units that are shown here, looking in the AHRI directory at those that are atmospheric there are three cast iron basic model groups. One of them has venting requirements that go above and beyond what's in the National Fuel Gas Code. The other two go up to about 120,000 BTUs per hour at the top end. That was as far as cast iron.

So, you know you're looking at, yes, those models are out there. It doesn't mean that they're widely used. You know basically they exit. And I don't have that data for the 84 percent at my finger tips. I think you will find something similar if you look at that.

MR. BROOKMAN: Go ahead, John.

MR. CYMBALSKY: Just a follow on, so my other thought is -- again, these are thoughts for everyone to chew on here. So, if, in fact, you are in an older home and in a home that appears to be in some disrepair, it appears to me that the installer would actually be more -- and the homeowner would be more cognizant of potential venting issues like chimneys that don't work so well or what not. To me the problems -- the oops come in where you look at something and you say this looks great, so you kind of ignore it.

When you go to a home that's built before 1950, nothing's been done to it, it seems to me that any mildly intelligent person would come in and say we got to look at these other things because this is an old home. There's bricks missing from the chimney you know further down the line. So, to me, I would take all those points into consideration before we say that a qualified installer is just going to ignore obvious problems with potential installation issue. So, that's where I'll end it.

MR. BROOKMAN: So, we have a comment from an individual who's joining us on line. Michael McDonald from PB Heating says if the chimneys must be relined would this also make the replacement of a water heater in that same chimney necessary? This is especially burdensome for an urban customer.

MR. DARLINGTON: We're going to get to

that.

MR. BROOKMAN: Okay, so we'll be responding to that. So, we left off, I believe, on Slide Number 39. Yes, please, Gary.

MR. HAINLEY: Before we move on, I wanted to comment. Gary Hainley with U.S. Boiler.

Frank had commented earlier that when we look at the statistics of distribution of models available that doesn't represent models sold. And models sold is really what impacts our history in the field and the experience, so U.S. Boilers sells products at each of these atmospheric levels, 82, 83, 84, 85; but the models sold at 85 is significantly lower than those sold at 82, 83. We also sell fan-inducted products at the 85 percent level, and I think that's where we see most of the model numbers in this at this level.

So, the field experience isn't with a chimney-vented product. A lot of it would be with an induced-draft product, so again, I think Frank will try to work with the manufacturers to -- or AHRI will work manufacturers to try to get some of that data that doesn't specifically provide manufacturer sales numbers.

MR. CYMBALSKY: This is John from DOE.

Thank you for that. So, my request was going to be a data request that the -- you know that's the Holy Grail of analysis, right, the shipment data by efficiency level. And obviously, we don't want to publish manufacturer-specific data, so anything you can provide through the NDAs that you may have set up with the consultants we would love that data. We would aggregate it to the industry-wide numbers and would certainly help us in our analysis and get to the points that we've been just debating here today. So, thank you so much for actually saying that for the record that you would try to provide that. That's awesome.

MR. HAINLEY: And to your comment or your question about do we have the same concerns at 84 percent as we do 85, I think the answer is, yes, that flue gas temperatures are very low for both of those compared to an 82 percent product. So, I think it really takes away the utility of existing chimneys.

And I think to think to the comments of you know what do installers do I think we need to get more data on that before we can comment further on what would the average installer do if they saw a chimney with pieces missing. I think the answer is most of them are going to fix it.

MR. BROOKMAN: Okay. Thank you. We're going to keep pressing ahead here, okay? Catherine.

MS. RIVEST: Thank you very much for all of your comments.

(Slide.)

MS. RIVEST: So, this rulemaking also considered a standby and off mode standards. So, DOE considered a single standby and off mode standards for each product class as it was found that most boilers do not come equipped with an off mode switch and in cases where off mode switches are present they're often not used as off switches, and so DOE used the design option approach due to the fact that there are currently no federal standards for standby and off mode for boilers and the measurements are not currently published by manufacturers. And the design options that had been selected in this engineering analysis were identical for each product class; however, the efficiency levels differed by product class due to differences in the baseline levels.

So, DOE established baseline levels based on product test data, along with manufacturer feedback. So, as I mentioned there's currently no ratings for standby and off mode, so DOE created a baseline product to be the most consumptive product on the marketplace. And DOE did this by adding together the most consumptive components for each product class. And you can see some of the key drivers are the transformers as well as the controls caused a lot of the standby and off mode.

MR. BROOKMAN: Steve Rosenstock.

MR. ROSENSTOCK: Steve Rosenstock, Edison Electric Institute.

I see that these are all I'll say the worse case scenarios for all of these different types of standby. And I was wondering what was the low end of the range if they were using, for example, a display that had the most efficient LED lights out there, for example, or they had the -- I'll say the mid-range transformer? I'm just kind of wondering what is the range? These are the worse case, but how low did it go in some of the actual installations out there.

MS. RIVEST: I'll have to get back to you on that, but generally, the best case units were ones with almost no electronic controls.

MR. ROSENSTOCK: Steve Rosenstock, EEI.

So, there were some things where the standbys were as low as I'll say 1 or 2 watts, right?

MS. RIVEST: That's correct.

MR. ROSENSTOCK: Okay, Steve Rosenstock, EEI.

I have some issues with this. Just again, just because I believe -- and this is going further on in the analysis is like it seems like it's a worse case analysis where what is the range of actual wattage in the standby is -- it's anywhere from 1 to 2 to 11 and the median or the average value is actually closer to I'll say 7 or 8 watts. I don't know what the actual number is. And then you have --

eventually, you're doing all this analysis where you know if they put in these more expensive controls you're actually using more watts than the baseline was using.

MR. CYMBALSKY: This is John from DOE.

So, what you're confusing here is what this chart is trying to represent, which is the baseline. Worse case scenario, as you put it, or most consumptive, as we put it. What the analysis does is then goes and sees what is the market share in there, and so this is trying to tell you what the worse case scenario is, the most consumptive case. And so it is "the baseline." And if you'd look to the next slide, if we could just advance you could see some of the best case scenarios, which is what we evaluated.

The disposition in the market today will come later and Victor will describe that, but just like every other rulemaking the market share is different than what is the most consumptive. Here we're just showing the most consumptive.

(Slide.)

MS. RIVEST: So, then starting from the baseline, DOE identified technology options that would produce the standby and off mode and implemented them in order of cost effectiveness. Are there any requests for comments on the standby and off mode? No?

MR. STANONIK: Quick question. Frank Stanonik, AHRI.

Okay, so on your standby -- the power reduction in the column on the preceding slide the reduction you're showing is that -- that wasn't clear to me. Is it cumulative or is it per the measure? In other words, so the first -- you know level one reduces it by 1.5. So, is level two is the total reduction, the 1.8?

MS. RIVEST: Yes, the total reduction is 1.8.

MR. STANONIK: Okay, so assuming all things are correct here, so for one dollar you would save 1.5 watts and for basically another 950 you're going to save me .3 watts? Okay.

MR. BROOKMAN: Steve Rosenstock.

MR. ROSENSTOCK: Steve Rosenstock, EEI.

And again, I don't know if it said in the technical support document -- if I did, please forgive me. What was the range of savings for these technologies? Is this the best case or worse case savings for this technology, or is this an average or median?

MS. RIVEST: These are the estimated -- what it was estimated to be.

MR. ROSENSTOCK: Estimated based on?

MS. RIVEST: Based on virtual tear downs.

MR. ROSENSTOCK: So, did you have watt meters when you put the technology in that you were always saving 1 watts or did it vary by a certain amount?

MS. RIVEST: So, it was done really more as an exercise of what would happen if we were to switch out these components, so we didn't actually you know change out the power supply from one unit to another.

MR. DARLINGTON: So, some of the estimates for the reduction are based on discussions that we had with the manufacturers and some of them are based on technical literature, papers that we found where they've actually looked at these design options and looked at what the difference is. And actually, I think some of them may have been observed differences in testing, in which case it would probably be the average.

So, for instance, you know we've seen units that use the switching mode power supply, but things like the low loss transformer that's going to be more based on literature. And if you go to the TSD, it cites the different papers that were used to determine those.

MR. ROSENSTOCK: Steve Rosenstock, EEI.

Again, I was trying to read through the technical support document, but it's still a matter of does this represent, again, because I think it's important. Does this represent an average savings with all the technologies out there, or would this represent the best case savings?

MR. DARLINGTON: No, it's more of a typical saving. So, if you put this in --

MR. ROSENSTOCK: So, you think it's the average.

MR. DARLINGTON: I wouldn't say it's definitely an average, but I would say it's supposed to be typical.

MR. ROSENSTOCK: Typical.

MR. DARLINGTON: If you put the best low loss transformer that you can find on the market in this is it you know it's more what was the one that was looked at in this paper.

MR. ROSENSTOCK: One model?

MR. DARLINGTON: Yes. Well, I'd have to go look at what they did in the paper.

MR. ROSENSTOCK: Again, Steve Rosenstock, EEI.

It all kind of pulls together because, again, depending on the range you know if the actual low end of the range by doing -- you know level one is you know .5 watts versus 1.5 watts then you have to scramble to get those extra watts from somewhere else. Now, it's probably available, but again, it's still a matter of -- you know you're talking about very you know kind of minimal savings here.

And so that's why -- you know if there's a significant range that could make a difference in terms of the actual design options that the manufacturers have. Just again, if it's somewhere in and buried in the support document or paper that's great, but again, I'm just trying to determine -- you know to make sure that there's multiple options here, that this wasn't just the best case or that there was some sort of a testing that kind of backs this up.

MR. BROOKMAN: Do we have additional comments on this table talking about standby mode and off mode? Comments here?

(No response.)

MR. BROOKMAN: Okay.

MS. RIVEST: So with that, I'll pass it along.

MR. FRANCO: Thank you, Catherine. Good morning. My name is Victor Franco from Lawrence Berkeley National Lab.

Next we will be talking a look at markup analysis and energy use characterization.

(Slide.)

MR. FRANCO: Markups are used to determine consumer prices from manufacturers' selling price for both baseline and higher efficiency products. The appropriate markups for determining consumer product prices depend on type of distribution channels through which the product moves from manufacturers to purchasers.

At each point of distribution channel, companies mark up the price of the equipment to cover their business costs and profit margin. There is one primary type of distribution channel describing the way most equipment passes from the manufacturer to the consumer, as shown on these two charts, the manufacturer going to wholesaler, wholesaler to mechanical contractor, and to consumer.

DOE also distinguishes between new construction and replacement application. Now, the replacement applications also include new owners for hot water gas boilers. The new construction applications are expected to include the general contractor, as shown in these graphs. The channels are shown again in these flow charts.

Also, for residential boilers in commercial applications represent about 7 percent of residential boiler shipments. DOE considers an additional distribution channel for which the manufacturer sells the product to a national account under both replacement and new construction markets. Further details are included in chapter six.

Based on information provided by manufacturer interviews, there's another possible distribution channel, which includes retail store instead of wholesaler. In this case, the manufacturer sells the equipment to a retailer who, in turn, sells to a mechanical contractor who, in turn, sells it to a consumer. However, DOE does not have enough information at this point to make a separate markup estimate for this distribution channel. DOE would assume that retail markup is similar to the wholesale markup.

DOE is also aware that there may be two additional distribution channels for residential boilers. One is the online distributions where the manufacturer sells the product to online retailers who, in turn, sell them directly to consumers. And rebranding distribution channel where the wholesaler or retailers negotiate good pricing from the boiler manufacturer based on high volumes and have the product customized to carry their name and then send it through the normal distribution channel to contractors. DOE did not use both of these based on limited data, and assuming that the market share for both of these is not very significant.

(Slide.)

MR. FRANCO: The method used to calculate the markups is based on analyzing the company's direct cost expenses and profits, using the data provided as shown in this table below. For the wholesaler markup, DOE uses the Hardy 2012 Profit Report. For the mechanical contractor markup, DOE uses both ACCA 2005 Financial Analysis Report data and 2007 Economic Census data. For the general contractor, DOE uses U.S. Census, 2007 Economic Census data. Sales tax data is available from 2013 Sales Tax Clearinghouse data.

Using this data, regional distributor and contractor markups as well as sale taxes were calculated for both residential boiler prices in both residential and commercial applications to match the regions in the building sample, which we'll be talking later in later slides.

MR. BROOKMAN: Steve Rosenstock.

MR. ROSENSTOCK: Steve Rosenstock, EEI.

Just a quick question, there was no more recent data for the markups from 2005 or 2007?

MR. FRANCO: Thank you for that question. Victor Franco.

The latest data is 2005 from ACCA. The Economic Census just came out with 2012 and we plan to use that more recent data. We believe ACCA produces every 10 years, 2015 would be the next one. We're expecting that at some point that might be updated.

MR. BROOKMAN: This is John from DOE.

Steve, do you have a reason to believe markups --

MR. ROSENSTOCK: Steven Rosenstock, EEI.

No, I was just kind of curious about the age of the data, that's all.

MR. CYMBALSKY: Okay. Thank you.

(Slide.)

MR. FRANCO: So, going on to the next slide, the baseline markups relate manufacturers' selling price to the consumer purchase price. To accomplish this, DOE applied the baseline markups to the manufacturers' selling price of the baseline equipment. The incremental markups relate to increase in the manufacturers' selling price of more efficient products to the increase in consumer purchase prices.

These markups only cover the expenses that vary with the manufacturers' selling price. Fixed costs such as overhead and labor do not scale with increased efficiency. The incremental markups were applied to incremental difference and MMP at each level above the baseline.

Based on the shipment analysis for 2012, the table below shows the fractions of replacement and new construction fractions. As you can see, the gas-fired boilers represent 90 percent of replacements and 10 percent new construction. Just to note, replacements in this case also include new owners, and we'll go over that in a little more detail.

In terms of new owners, 20 percent of that 90 is new owners, so 18 percent, oil-fired accounts for 2 percent of new construction. For electric hot water, 23 percent are new construction. And for all steam boilers, we assumed zero percent new construction.

(Slide.)

MR. FRANCO: This next slide provides the overall results for the markups. The first table presents the results for the market participants in the residential applications. The manufacturer markup is 1.41 and then the wholesaler, mechanical contractor, general contractor for the new construction is show as well in the sales tax. Based on these numbers, we come up with the overall markup. Again, this is an average. In the analysis, we applied this by region.

The average markups by product class accounting for replacement, new construction, commercial applications and the regional difference in markups are shown below by product class. For example, for gas-fired hot water boilers, the baseline average markup is 3.27 and the incremental average markup is 2.107. DOE requests comments on its markups analysis.

MR. BROOKMAN: Frank Stanonik.

MR. STANONIK: Frank Stanonik, AHRI.

We're just -- well, not just, but we're kind of digging into this one a little bit for the furnace rulemaking. And I'm going to hedge a little bit here because we're still gathering the information and trying to make sure we properly analyze it, but starting to get a hint that this idea that as you have incremental improvement in the product or whatever that the markup changes.

We're getting feedback from -- we're surveying -- trying to survey contractors and we're getting feedback that that's not the case, that their markup is their markup and they don't really care whether it's a baseline or a deluxe or whatever. We hope to do a similar attempt at a survey with people who install boilers and try and get that done in time for whenever the comment period closes.

But again, in the past, I think we've kind of just not dug into this one too much, but now that we do have a kind of -- at least getting some hints of answers that say there's, at least some segment of the contractors, this isn't the case. I'll try and give you better data.

MR. BROOKMAN: Thank you, Frank, that's helpful. Appreciate that. Additional comments here on markups because we're about to take a break. Final comments on markups?

(No response.)

MR. BROOKMAN: Let's take a break. We've covered a lot of ground already. It's 10:35 approximately. We're going to break for 15 minutes, which means we'll resume at 10:50 here in this room.

(Whereupon, a short recess was taken at 10:35 a.m.)

MR. BROOKMAN: We are going to pick up

where we left off. Thanks for your comments so far, good comments, and we're going to keep on with that. Victor Franco's going to continue.

MR. FRANCO: This is Victor Franco again.

We're going to continue on to the energy use characterization.

(Slide.)

MR. FRANCO: We're going to continue on to the energy use characterization. The purpose of the analysis is to determine the annual energy consumption at every efficiency level to find the annual energy costs and savings.

DOE considered three components to the energy use analysis. It considered the space heating fuel, the water heating fuel, and the electricity use associated with the water heating and space heating. DOE did not consider other applications such as snow melting or other applications where boilers are used.

In terms of each individual component, we'll go into more detail, but basically space heating is calculated by using the burning operating hours and multiplying it times the input capacity.

And we determined the AFUE of the -- used by determining the AFUE efficiency level. We used RECS 2009 and CBECS 2003 to determine the heating energy used, and we used some other adjustment factors we'll be describing in further detail.

For water heater, we used the AFUE at each efficiency level. We used RECS 2009 and CBECS 2003 data for the water heating energy use and we applied some adjustment factors.

The electricity is determined using the burner operating hours to determine for space heating and water heating and multiplying those time the power ratings of the electrical components. Standby and off mode is also considered. The electricity use was calculated using the standby and off mode operating hours as well as the power ratings for each technology option. It is important to note that for this analysis we're considering single-stage controls for all non-condensing boilers and condensing hot water oil boilers. For all condensing hot water boilers, we assume modulating controls. Obviously, there are models out there with two-stage modulating controls for non-condensing and there's some condensing with single-stage controls.

(Slide.)

MR. FRANCO: Since we discussed that CVAC and RECS data is very important for the development of the energy use characterization, here a slide describing the determination of the building sample.

So, we start up with the whole RECS 2009 sample and CBECS 2003 sample to determine what buildings have a residential boiler. The considerations are listed here.

First, the boiler is the main or secondary source of heat. The boiler uses heating fuel that is natural gas, LPG, electricity or fuel oil. The heating energy consumption is greater than zero and the heated square footage is less than 10,000.

Next, we disaggregate to come up with a byproduct class, first, by fuel, gas, oil, and electricity. RECS and CBECS do not distinguish between hot water and steam applications, so DOE used all the sampled households for the gas-fired hot water, oil-fired hot water, and electric hot water sample and assumed that the gas-fired steam sample were building built before 1970. Before 1970, steam was more prevalent, so we assumed that buildings before 1970 might include steam, so that's where the sample comes from.

Some of the samples statistics are provided in this table. It's important to note these are the weights of the number of buildings from RECS. DOE adjusted these weights based on shipments data provided by AHRI from 2008 to 2012.

Next, let's go into more detail about the energy used in the space heating. Again, the annual fuel use is a multiplication of the burning operating hours and the boiler input capacity. For this analysis, we calculated the fuel use using the currently proposed federal test procedure for boilers, which is in the NOPR stage. A public meeting was a month ago.

The boiler input capacity is derived using a sizing criteria methodology. We assume that the same size input capacity is the same for all efficiency levels. So, if a household is designed at

200 KBTU per hour boiler at 82 percent for hot water gas boilers, at 90 percent AFUE the input capacity is the same, 200 KBTU even though the output would be different.

We used the following household characteristics to come up with the sizing. We used the square footage of the building provided in CBECS and RECS data, the vintage, the foundation type, shell characteristics, and number of floors. In addition to this, we matched each household to an outside design temperature and we matched each household to an existing AFUE based on the age of the boiler and historical shipment data by efficiency.

Lastly, we assumed an oversized factor, that currently test procedure assumes at 1.7 oversize factor and that's what we used for this analysis. The results of this is we pretty closed matched the historical shipments data that we have by input capacity. The comparison is available in Appendix 7B.

(Slide.)

MR. FRANCO: Next, we come up with the

burner operating hours. The burner operating hours are the building heating load divided by the useful output. We assume that the building heating load is the heating load served by a single boiler. So, if a household has multiple boilers, we assumed the heating load by that one single boiler were being analyzed.

The useful output includes the energy delivered to supply the water, the energy to the environment that's provided from the boiler, and the electrical losses that also go into the space potential.

(Slide.)

MR. FRANCO: Let's go into more detail into the burner operating hours. So again, the burner operating hours are the building heating load divided by the useful output. The burner building heating load served by a single boiler is described by the follow equation. We use the fuel consumption of the heat based on RECS for 2009, that's the QYR parameter, that's the fuel consumption of the household or building. We adjust this to account for the existing boiler efficiency.

The existing boiler efficiency is further adjusted to account for the field conditions. And what we'll describe how the AFUE both for the existing and take into account the installation hot water return water temperature and other factors. In addition, we make some further adjustments to the building heating level. We take into account any secondary heating equipment that's being used. RECS do list some households that use other equipment, such as direct heating equipment in the same household and so we subtract that.

We take into account also the building shell efficiency in 2020. This is based on the AEO 2013 data. The average climate conditions come from the 10-year average from NODA heating degree data. To account for potential trends in heating degree data from 2013 to 2020, we base it on AEO 2013 data.

We take into account the boiler count. So, if there's more than one boiler in the household, we divide that by the number of boilers and the number of units household or housing units that are served by the boiler. So, for example, in the multiple family application if the boiler is shared between many households, then we multiply that time the number of units that are being shared by the boiler.

Lastly, we determine the useful output. The useful output is basically the useful electrical heat. And this comes from the current test procedure, depending on the installation location and the input capacity we described earlier times the AFUE of the new boiler. We adjust the AFUE to account for field conditions.

MR. ROSENSTOCK: Steve Rosenstock, Edison Electric Institute.

Looking at Table 733 and 734 of the technical support document, I'm seeing the range of heating loads and boiler annual operating hours. And I appreciate you know this very well done. It's showing the averages and then the percentiles. And I guess 50 percentile that would be kind of the median value. Wouldn't that represent kind of the median value based on the analysis?

MR. FRANCO: That is correct, yes.

MR. ROSENSTOCK: So again, I'm just being a numbers geek here -- Steve Rosenstock, EEI.

I'm seeing a significant difference between the median value and the average value somewhere along the order of like 20, 25 percent for many of the categories. So, I was just kind of curious. I know that's going to vary by climate zone and everything, but when I see such widely scattered data, wouldn't it be better to start with the median value rather than the average value when they're so wide apart, when they're so -- when there's such a wide range of data and there's such a big difference between the average and the median values?

MR. FRANCO: This is Victor Franco.

So, in our analysis, we calculate household-by-household, so we don't use average or median.

MR. ROSENSTOCK: Thank you.

MR. BROOKMAN: This doesn't really fit in the current stream, but we might as well as it now. One of the individuals joining us on line, Mark

Krebs, asks there are many makes and models of tankless water heaters with sufficient capacity to take the place of boilers. Are tankless water heaters considered in this Notice of Proposed Rulemaking?

MR. FRANCO: So, we'll go into a little bit of detail into that actually in this next slide, but we assume tankless the terminology we got from manufacturers and others is we define them as low mass boilers, and so some of the tankless are low mass boilers. And we'll discuss how we consider those into the analysis in terms of energy use.

MR. BROOKMAN: Thank you. Yes, Frank Stanonik.

MR. STANONIK: Okay, Vic, are we still on Slide 52?

MR. FRANCO: Yes.

MR. STANONIK: No, back up a minute, if you will. Let's go back to -- yes, that one. Okay. Thank you.

Not being real familiar with the AEO data on building shell efficiency, do you know is that looking only at single-family dwellings?

MR. FRANCO: This is Victor Franco.

The model is actually looking at single-family, multi-family buildings. The value that we used is an aggregated value, but it's separated between single- and multi-family in the actual AEO values, how it's produced.

MR. STANONIK: Okay. And Frank Stanonik, AHRI.

I guess then I'll have to -- we'll have to dig into it. I guess my concern is, again, I'm even becoming more aware -- you know we have a huge percentage of boilers that are in multi-unit buildings and so now I have an issue -- not an issue, but a factor that you have shared walls between units and I would say that's not really even a shell, right? I mean you know, again, I keep thinking of either multi-family or the row house as well. If I'm one of those middle row houses, my shell is very different than the people on the end. We'll look at that. Thanks.

MR. CYMBALSKY: This is John Cymbalsky

from DOE, former EIA employee for 20 years, and actually developed the model you're talking about, so maybe I can add some expertise.

So, the building shell, like Victor said, is parsed out by housing type. The attached homes that you're referring to are in the single-family bucket. The multi-family bucket, the high rises, my understanding -- and Victor can correct me if I'm wrong, but the vast majority of the big, multi-family units are the big boilers that are not residential boilers, so they would not be in this rulemaking. So, I think you can just pretty much ignore that. And if your comment is for us to just use the single-family value, maybe that's the helpful comment here. That might be more appropriate.

MR. STANONIK: Frank Stanonik, AHRI.

John, I'm kind of definitely more focusing on let's say certainly not high rise. You know maybe, again, easily visual idea is the row home, but even maybe garden units where maybe you have only two or three stories of units which still might lean towards individual products as opposed to -- you know when you get into big buildings you got a big boiler.

MR. CYMBALSKY: This is John again from DOE.

I don't think that's very common. I could be wrong, but I think the majority of these, the row houses definitely I can understand, the old row house; but the garden style apartment type stuff they're not going to have boilers.

MR. STANONIK: I would think post-1950.

MR. CYMBALSKY: I would think so too.

MR. RODA: This is John Roda, Burnham Holdings.

There are a number of rental units in Lancaster, Pennsylvania. And I don't think this is so atypical that were broken into two and three unit apartments. At one time, they were a single-family home. Before codes got around and started restricting it, people converted the three or four-bedroom, three bath house to three units and those do use residential boilers.

MR. FRANCO: Thank you. Victor again.

MS. SHEPHARD: Actually, can I ask a

follow-up question. So, you mentioned -- Amy Shephard from AHRI. You mentioned it used the AEO 2013 data. Is that same data available in the AEO 2014?

MR. CYMBALSKY: Actually, now AEO 2015.

MS. SHEPHARD: Okay. And so why did not use the 2014 data; is there any difference in the data?

MR. CYMBALSKY: I'm sure it's different. The analysis here was done quite a long time ago, so we will update it as we normally do for every rulemaking. The analysis here -- this rule was at OIR for quite a bit of time, as you're probably aware. So, I'm thinking this analysis was done in 2013. Yes, because we submitted it I think April 2014. So, we did this analysis in the calendar year of 2013, for the most part.

MS. SHEPHARD: Okay. So, I guess we would be interested in whether there's any significant changes in the data. And then I just wanted to clarify something. The slide on 51 says that the calculations were based on the proposed test procedure, but you said the useful output was that using the current test procedure? Did I get that right or did I mishear?

MR. FRANCO: No, everything is accounting for the new test procedure.

MS. SHEPHARD: Everything's under the new test procedure?

MR. SHOLER: So, I guess my question -- Paul Sohler.

The burner operating hours I think that is different in the 2015 proposed procedure versus what we're currently using; is that correct, the method by which one calculates burner operating hours?

MR. FRANCO: That is correct. In the test procedure there's kind of an appendix not related to AFUE calculations that calculates burner operating hours and then those are used to calculate ESAEVE, which is electricity EF. Those do change. They're mainly due to the calculating two -- more properly calculating two-stage modulating equipment. We used those calculations for this analysis.

MR. SHOLER: Okay. I guess my question is is there -- well, is there a reason for using the new -- you know this is a proposed procedure versus what is established right now.

MR. FRANCO: Yes, those, again, don't affect the AFUE rating. Those are mainly to better calculate the electricity and fuel use. The corrections are to account for modulating equipment in two-stage equipment. They don't really impact single-stage boilers.

MR. SOHLER: Okay. Thank you.

(Slide.)

MR. FRANCO: Okay, so the next couple of slides describe how we adjust the AFUE to account for field conditions. So, it's important to note first that we do the adjustments for both the AFUE of the existing and new boiler. So, what we were trying to take into account is what type of applications that the boiler is in, in terms of the return water temperature.

We also make some assumptions about the automatic means that's being used for the boilers and any accounting of the jacket losses associated with the boilers. So, for instance, let's talk about the return water temperature adjustments.

They're based on the high and low return water applications. The high return water applications are mostly to units associated with non-condensing boilers. We assume at average 160 degrees Fahrenheit, and these applications include corrective baseboards and panel radiators that typically are about from 140 to 180.

The low return water temperatures are mostly associated with condensing technology. We assume an annual average of 110 degrees. These are associated with in floor radiated tubing as well as it could potentially be a little bit higher for either roof or wall panels, and also associated with panel radiators, which have a potential to have a low return water temperature.

We assume it's similar to the test procedure that the temperature difference between supply and return water temperature is 20 degrees.

Next, we account for the automatic means adjustments. So, we apply adjustments to all equipment installed after 2012, which mandates the use of automatic means. For single stage, we assume that the adjustment is -2 degrees and just for the return water temperature. For modulating equipment, we assume that's a 10-degree difference in the low return water temperature applications.

In terms of the jacket losses, we applied jacket losses to boilers installed in non-condition spaces. We'll describe in the installation model the fractions and further detail of how we determine non-condition basements and garages, but 35 percent of gas-fired boiler installations are in non-condition basements and garages and 53 percent of oil-fired boiler installations.

So, for these we take the jacket loss factor into account based on the current test procedure, which is based on EISA 103, the proposed test procedure -- sorry -- based on EISAR 103 2007. The jacket loss factor is 2.4 percent. For low mass boilers, we assume that this is much lower, so we assume that it's 10 percent of this value, and that would 0.24 percent.

In terms of low mass and high mass, we assume that 75 percent of condensing boilers are low mass and 25 percent of non-condensing boilers are low mass.

MR. BROOKMAN: Yes, go ahead, Roger.

MR. MARRAN: Yes, Roger Marran, with Energy Kinetics.

I just want to point out I guess when we're taking a look at a few things with jacket loss adjustments and that jacket loss being in a non-condition space or weatherized there's a difference in how that plays out. And I know the standard treats it in some ways, but some of the field studies and some of the Department of Energy lab studies treat it very differently without a loss.

And from that standpoint, I just want to point out also that jacket loss for the mounting place inspection and access work panels can be omitted in the standard and for a lot of equipment that's a huge section of loss that's not addressed when we look at these two, and that plays more into the idle loss characteristics too, so it's much greater opportunity for gains based upon better installation application in those kind of areas without the need to maybe adjust the AFUE base structural thereto.

MR. BROOKMAN: Thank you. Yes, Frank Stanonik.

MR. STANONIK: Frank Stanonik, AHRI.

Victor, the last thing about your percentage assumptions on low mass and not low mass is that for all boilers? I don't have a real good sense of the oil boiler market, but those numbers to me would look a little off if I were just talking about oil boilers in terms of the low mass/high mass issue.

MR. FRANCO: Thank you for that comment. Yes, for this analysis we do assume these fractions are the same for all. Condensing boilers are a small fraction of the market in the oil, but yes, they are assumed to be. So, if you have any information or input that would be really useful to us.

MR. BROOKMAN: Yes, Paul.

MR. SOHLER: Paul Sohler.

I'm trying to find it right now, and I'm not able to, but my recollection was that the default jacket loss for all indoor or all boilers was 1 percent. I don't recognize that 2.4 percent number. Where'd that come from?

MR. FRANCO: This comes from the test procedure. There are actually two kind of jacket loss factors in the test procedure. One is a 1.7 percent factor and this is 2.4 percent factor. This is to adjust for the AFUE. They're factors used just for the output capacity.

MR. SOHLER: Okay. And this is, again, different in the current versus new standard?

MR. FRANCO: This actually does not change. It's actually the same between those.

MR. SOHLER: Okay. Thank you.

(Slide.)

MR. FRANCO: So, next, we'll look at a little bit more detail the actual factors and how they're applied. So, here on these tables we show the actual decrease or increase of AFUE rating based on our assumptions that we described earlier. So, the first table describes boilers, single-stage boilers, both non-condensing and condensing with high and low return water temperatures. In addition, for high return water temperatures we account for when the boilers don't have automatic means and have automatic means.

So, as you can see for non-condensing, we decrease the AFUE rating by 1 percent. So, if the boiler is rated at 82 percent AFUE, the actual efficiency in the field would be 81 percent. For condensing boilers, we decreased it by a little more than 3 percent. So, if a condensing boiler is at 90 percent AFUE, the actual field efficiency would be a little bit less than 87 percent AFUE. So, this is to take into account that sometimes it won't be actually condensing.

For low return water temperatures, since this is below the AFUE -- I forgot to mention. The AFUE's rating is at 120 degrees. Because it's below the 120 degrees the adjustment is a positive 2 percent. So, if the AFUE of the boiler condensing is at 90, the field adjusted rating would be at 92.

Similar adjustments are done to the modulating boilers and you can see the numbers there.

(Slide.)

MR. FRANCO: To further describe, the graph below shows how we come up with these for condensing equipment. So, as you can see the rating is at 120; that would give you maybe a rating of 90 percent. If you go below that to 100, then you would go to 93. If you go above that to 140, you go to 97.5. That's how we determined these values.

These trends or this graph is based on manufacture literature and models, but specifically this graph is based on thermal efficiency. This is a commercial product, and we assume for this case it's similar to AFUE.

Now, the return water temperature for condensing installations -- this is mostly applicable to hot water gas boilers as follows. So, based on market segments, we have new construction and new owners. We assume that 100 percent of installations would be at the low return water temperature. So, we assume that the people that are going to be installing in new construction and new owners will be installing the low return water temperature, which is the most beneficial for condensing.

In terms of replacements, in households built after 1990, we assume that half of those would be using a low return water temperature application. For replacements built before 1990, we only assume 10 percent. And that 10 percent is really to account for some situations were some of the building owners actually did do a remodel of their building.

MR. BROOKMAN: Frank Stanonik.

MR. STANONIK: Frank Stanonik, AHRI.

Victor, I'm thrown a lot here, okay, and I'm hoping I'm reading this wrong. So, this slide is telling me that when you factored in the affect of the automatic means it lowers the AFUE, that there's no energy savings in the standard that was passed whatever many years ago; is that what I'm understanding?

MR. FRANCO: So, it does increase it, but very, very slightly. It would be very interesting to understand better how the current automatic means of non-condensing equipment, which we believe for single-stage equipment, is this post-purge, does actually affect the AFUE. Our understanding it does lower the temperature very, very little, but it would be good from manufacturers perspective to get a better understand.

MR. STANONIK: Frank Stanonik, AHRI.

And so what about those non-condensing products that might be multi-staged? It looks at the moment you didn't look at that one, or didn't try to estimate that one.

MR. FRANCO: That is correct. Thank you so much for pointing it out. So, the first slide for energy use I did point out that for all non-condensing and condensing for hot water oil boilers we assumed that they're all single stage.

MR. STANONIK: Okay.

MR. FRANCO: And it would be good to have either shipments data to account for those or have input.

MR. BROOKMAN: Paul.

MR. SOHLER: Paul Sohler.

This curve here you said is based on manufacturers' data. Is it residential or commercial, the data where that came from?

MR. FRANCO: This is commercial. There is a similar graph in the ACCA handbook which is supposed to be applicable for both residential and commercial applications. We don't have how the ACCA chart was derived, so we used this which we had the data for. We'd appreciate it if you have actual data for residential application.

MR. SOHLER: I think some actual data is in order as opposed to using sales literature or whatever published literature it is. If DOE needs to go and generate that, so be it.

MR. FRANCO: Thank you. Appreciate that.

MR. BROOKMAN: Yes, please, Gary.

MR. HAINLEY: Thank you. Gary Hainley, U.S. Boiler.

Question on the return water temperature fraction for condensing installations lower left chart, I recall that it was mentioned that for replacements where there was a new owner that that was still considered part of the replacements. So, your assumption is that if there's a new owner to the home that they're going to have a system with low return water temperature?

MR. FRANCO: That is correct in terms of if they're installing a condensing boiler. Since they have the option, at that point of installing a non-condensing, for the non-condensing they would go to potentially a high return water temperature application. For the condensing, they would go to below return water application is the current assumption.

MR. HAINLEY: So, Gary Hainley, U.S. Boiler.

I don't believe that's a reasonable assumption because it requires that the heat distribution system be replaced and that's a huge cost to do that. I think if you have you know let's just say 10,000 square feet of radiation that requires a certain temperature to provide the heat output. To get that to a lower temperature system, you're going to increase the square foot of radiation or in the case of radiant flooring you have to do a whole new staple up application.

So, I think that's an incorrect assumption. I think that the new owners, for the most part, are going to be exactly the same as just any other replacement. What's there is the heat distribution system, whether it's condensing or non-condensing.

And the other statement I would make would be replacements built after 1990 for homes built after 1990 I'm not convinced -- and again, I don't have data to support that, but I don't believe that's going to be any different than the home built in the 1950s. I think the majority of these are going to be some type of high temperature radiation. You know high level homes there's always been a percentage of those that have gone to low temperature baseboard or in-floor radiant heat, but that's a small percentage of the population. Thank you.

MR. BROOKMAN: Thank you. Yes, please.

MR. MARRAN: Yes, Roger Marran with Energy Kinetics.

Yes, I think to add to that too I think with new construction the builders, in general, are going to go low cost if they can, which means if somebody can put in the minimum about of radiation they need in order to satisfy the home the contractor may move in that direction certainly, arguably for a large percentage of that market. Custom homes may be a little bit different.

So, from that standpoint, I think they would dial up the temperature of the boiler and minimize the radiation to reduce the overall cost. So, it's something to look at there to support that point too.

MR. BROOKMAN: Okay. Thank you.

MR. FRANCO: Thank you so much for all those comments. Just to clarify, because I went really quickly over the new owners. The new owners we're considering for the LCC, and we'll go to the shipments analysis, are potentially people that switch from other prior classes from boilers. So, you would be correct in that case. They currently have a distribution system. A fraction of those also include people that do actually purchase this as new equipment, so they might do a major remodel. They might've had some other type of distribution or something.

The 20 percent that we apply in this sale for the analysis is for people that do completely boiler, so they didn't have a boiler before. They're actually doing a new distribution. And we'll go into further detail in the shipments analysis, the other fraction that actually do product switching that's not accounted here in this LCC.

(Slide.)

MR. FRANCO: So, the next slide we look at the distribution of heating energy use. So, this is concluding the heating energy use discussion. Here is the distribution based on the 10,000 households, and below are some of the values for the four prior classes we are considering for the AFUE standards.

The first column presents the results based on just the raw energy use data provided from CBECS and REIS and the median and average values. The median is in parentheses, and the estimated energy use in 2020 is provided in the next column. As you can see, there's a significant decrease, about 23, 24 percent in the energy use that we're calculating.

MR. ROSENSTOCK: Steve Rosenstock, EEI.

For the 2020 value, what was the primary driver for that reduction? Is that building shell or just overall -- just new shipments or what's the primary driver?

MR. FRANCO: It's actually pretty interesting there. Actually, all about the same, the different adjustments, so building shells is slightly greater. It's about 7 percent. Actually, the adjustment from the heating degree data is from 2009 to 2013 to an average, heating degree data accounts for another 5 percent, adjusting for trend between 2013 and 2020 another 5 to 6 percent, and finally, doing the adjustment -- instead of the current AFUE, which might be below 80 AFUE to the new at least 82 percent AFUE that accounts for another 4 or 5 percent. The last bit of the change is due to this adjustment for secondary heating equipment.

MR. BROOKMAN: Frank.

MR. STANONIK: All right, Victor, the distribution of heating energy use, the X axis I'm reading as dollars, so either if you could help us out by maybe telling us what you assumed is the per unit fuel cost or maybe fix whatever needs to be fixed; but right now I'm having trouble trying to look at what appears -- you know the peak seems -- the peak on this chart, if I had to guess, looks it's maybe 40 something, whatever that unit is. And yet, you're telling me the average is like 95 million BTU. Something needs to be fixed, please.

MR. FRANCO: Thank you so much for that comment. Well, let me clarify. So, this chart shows the second column, which is the estimated heating energies in 2020. The average value -- and this is just for hot water gas boilers. The axis should be labeled a million BTUs per year, so it would be around -- the peak would be around 50 -- 45 to 50 and the median is listed on this table as 56. The average would be 75, so it's -- as you can see, there's like a --

MR. STANONIK: Okay, so this is a million BTUs.

MR. FRANCO: A million BTUs per year, yes. And I'm sorry about that.

MR. STANONIK: (Off mike.)

MR. FRANCO: That is correct.

MR. ROSENSTOCK: Steve Rosenstock, EEI.

The graphics is for 2020 is what's being shown here, right? Okay.

MR. FRANCO: That is correct. And this is just for efficiency level zero, so it's 82 percent AFUE.

MR. CYMBALSKY: I think just to clarify so it's the first row of the table, essentially, plotted out for the distribution in the year 2020.

MR. MARRAN: Yes, Roger Marran with Energy Kinetics.

When I was looking at Table 7B2.8, the heating degree, the adjustment factors in the baseline year I think that at Hughes actually had the highest heating degrees of all the samples of that 10-year period was taken. It was the coldest period, the coldest baseline year. The one in the RECS, 2009 regions, that was based on the NODA data. I just wanted to bring that up because I thinking about the 5 percent reduction going from 2009 towards the 2013 and that may have a significant impact towards that.

(Slide.)

MR. FRANCO: So, moving on to water heating energy consumption. So, DOE took into account the energy use by this boiler for domestic hot water. RECS and CBECS do not report of the boiler's use for water heating, but DOE are aware that a lot of these boilers are used for water heating as well, so DOE used the following assumptions.

For buildings that are listed with the tank water heating and using the same fuel between the space and water heating, DOE assumed that 50 percent of the time the boiler is used for water heating. For buildings with tankless water heating -- and this is mainly for oil equipment -- 100 percent of the buildings are assumed to be used with both the boiler -- the boiler for both space heating and water heating.

In terms of the actual calculations of the annual water heating fuel consumption, DOE uses the hot water formula that's been used before in other rulemakings and adjusts it to be applicable to boilers. So, in that sense, the formula has the water heating load divide by the AFUE, which was adjusted so that it becomes an actual kind of a water heating efficiency. And the last part of the equation adjusts for the standby losses associated with using the water heating. We'll be describing those in a little bit in further detail.

The adjustment factors for water heating in terms of AFUE account for the differences between the AFUE and the water heating efficiency, adjusting for the difference between AFUE and the study state efficiency, jacket losses in non-condition space, and also adjustments for tankless coil. This is mostly associated for oil equipment.

Lastly, we take into account water heating loss. We assume a .5 kilowatt KBTU per hour for indirect tanks and zero loss for tankless coil water heaters.

The last equation in this component is the water heating load. We take the water heating load from the RECS data that reports the water heating energy use and we further adjust it based on the AFUE of the existing boiler and make the similar adjustments that we did before.

MR. ROSENSTOCK: Steve Rosenstock, EEI.

On that, where you say 100 percent of buildings uses tankless water heatings, if they had gas equipment would that same assumption apply?

MR. FRANCO: That is correct. In RECS 2009, there is a very, very small fraction of tankless.

MR. ROSENSTOCK: Steve Rosenstock again.

So, even though the tankless water heater efficiency is higher than the boiler efficiency that no one would ever use the tankless water heater; is that what I'm hearing?

MR. FRANCO: No, let me clarify it. What happens is that RECS reports just that there's a unit of water heating that has either a tank or is tankless and it doesn't mean that it's a tankless water heat. It just means that there's no tank associated with it and that its fuel. So, for example, that's an oil or gas.

If we find that the boiler is of the same fuel, then we make this assumption that they're actually using the boiler for doing both, so space heating and the water heating.

MR. ROSENSTOCK: Okay, Steve Rosenstock, EEI.

Again, I don't have that type of equipment, but again, if someone -- so again, looking at the RECS data, if for some reason they put in the tankless water heater because they wanted to do that to shutoff the boiler, you can't really account for it because the data doesn't really break it out even though that's what the homeowner wants to do for I'll say efficiency reasons or they just wanted to keep the space heating and water heating systems separate you're not able to adjust the analysis for that.

MR. FRANCO: Just to clarify, so for gas equipment it's a very small fraction. It's less than

1 percent, and so we didn't make any further adjustments. For oil it's very common that you would use kind of a tankless coil in that situation and that's --

MR. ROSENSTOCK: It's really a separate system, so understood. Yes.

MR. FRANCO: And the tankless is mostly associated maybe with a forced furnace, for a draft furnace situation.

(Slide.)

MR. FRANCO: So, the next slide shows the similar distribution of water heating energy use. So again, we have the hot water fuel energy use. The access is correct now. It's a million BTUs per year and it's for efficiency level zero. And you can see the distribution here. This is for 2020 values. The values by product class are provided in the table.

The actual fraction of boilers that use water heating equipment is similar. It's about 40 percent for all products. And the water use is very similar. It decrease by about 1 million BTU, but the main difference between -- the RECS provided data and the energy use that we're calculating in 2020 is because of the efficiency of the equipment. There's no other adjustments in this analysis.

MR. MARRAN: Yes, Roger Marran with Energy Kinetics.

I think some of these where I look at, for example, hot water oil boilers there's a huge market penetration for the tankless coil type boilers that make heat and hot water. I think that number is going to be a lot higher than what was shown here. I'm not sure how you can get industry data to demonstrate what that might be, but I suspect that number is much greater than that. And I've heard other companies cite also the percentage that has indirect tanks with a boiler that's much higher than those, the 40 percent average as well. So, those couple of things might impact this too.

The other question that I had was the adjustment factor to AFUE to calculate the hot water efficiency do you have a magnitude of what that adjustment number was that was used.

MR. FRANCO: It's provided in chapter 7.

There's actually a pretty big equation there. There's actually three components to that equations which is similar accounts for the jacket losses and it depends on what the water heating, but it's around 2 to 4 percent, depending on what type of -- low mass/high mass. If it's an indirect tank, it's a tankless coil.

MR. MARRAN: Yes, Roger Marran again from Energy Kinetics.

So, my question relative to that or statement, I guess, relative to that would be I know -- to refer back again to the Dr. Butcher study on the performance of integrated hydraulic heating systems in that study he published some of the water heating efficiency factors and those numbers varied from around 30 percent for some tankless coils all the way up to I think 79 percent for the top-performing system, but there's a significant gap between the AFUE for that study and how it was treated.

I understand that the idle loss that's treated in there is considered as a gain in the condition space for the purposes of AFUE, but in that study it wasn't considered as a gain, so there's a disconnect between those two, but it's certainly a broad factor that should be applied in the application of where the energy efficiency comes from and for the opportunity for gains in home performance would be.

MR. FRANCO: Thank you. I appreciate that comment. And let me just clarify that when we do the energy use for the water heating the efficiency that was mentioning, the 2 to 4 percent is applied to the AFUE component. There's also the standby losses. So, if you account for standby losses that would be different that's similar to what you're mentioning. So, for applications it could be a 10 percent say or greater.

MR. MARRAN: Roger Marran from Energy Kinetics.

Now, earlier we mentioned there was a certain percent that were in condition space and some were weatherized, so that's taken into account? That flows through the process to address that?

MR. FRANCO: That's correct.

MR. MARRAN: Okay. Thank you.

MR. FRANCO: Just one clarification, also for the oil burners, I thing one thing to be considered, this is RECS data. There's a lot of oil boilers that are associated with different water heating types, so there's significant market that has for, example, electric water heaters associated. So, these fractions take that into account, but we really appreciate data on that.

MR. BROOKMAN: Yes, please, Frank.

MR. STANONIK: Frank Stanonik, AHRI.

Victor, these numbers on the average water heating energy use seem high, and we will certainly try and give you some much better analysis numbers on that, okay, but I'm just going to use my own holist, okay. And you know I'm probably one of those weird people that look at their gas bill. So, in the summer my gas bill when I'm basically heating water and maybe running my grill, okay, I'm using about 15, 16 therms a month, okay. So, the crude calculation here, so if that's my water heating energy on an annual basis I'm using like 180 therms per month, okay.

You're showing roughly for a gas product probably about 50 percent more than that. I'm going by the 28, okay. And again, there may be other factors here, but we'll try and get into that a little further and even look at some of the other data on average water energy use. I mean for other reasons I did something looking just a California because we've got an issue with the California Energy Commission. And again, California a typical residential hot water use ran about -- I think it was maybe 17, 18 therms a month, so it's a little high and we'll try and maybe better identify maybe where it's overestimating.

MR. BROOKMAN: Thanks Frank. Yes, Paul.

MR. SOHLER: Yes, Paul Sohler.

I would, yes, just note, and I'm having a little trouble and I don't want to belabor trying to understand how you came up with the fractions as boilers used for water heating. The one thing that definitely jumps out to me is the steam gas boiler number being you know 40 percent basically seems very, very high. And I think we can probably provide some data to you know better reflect what that actually is.

MR. BROOKMAN: Okay. Thanks.

MR. FRANCO: Thank you. We really appreciate that. That's actually one of the questions we were going to propose to ask. And basically, we assumed the same for all of them and we wanted to get your feedback on that.

To come back to the water heating just really quickly --

MR. BROOKMAN: Yes, Rick, a question. Go ahead.

MR. MURPHY: Yes, Rick Murphy, AGA.

Just curious as to how these fractions of boilers that are used for water heating how that comes into play in the water heating standard. Are these numbers considered in that and are they consistent?

MR. FRANCO: The last time the water heating standard was 2010. We used RECS data from

2005 at that point. We didn't account for a fraction of boilers that might be using water heating. That would certainly be considered for the next round.

So, just to clarify, the estimate this is just for boilers for water heating. If you looked at all households, it runs about 18 to 20 in BTUs. It would be interesting to see what kind of characteristics -- this is just boilers. We appreciate any feedback.

MR. STANONIK: Yes, Frank Stanonik, AHRI.

And Victor, I think the part we want to look at ^^^^ I mean, again, certainly there's an immediate difference that let's say your heat generator is probably firing at least at twice the rate of what your standard stand-alone water heater would be doing, but you know there are some differences. We need to kind of filter it out and see, okay, but does that really explain why when you do this you have what appears to be a higher energy use for heating you know on the average basis the same amount of hot water, right?   We'll look into it.

MR. FRANCO: Thank you.

(Slide.)

MR. FRANCO: Moving on to electricity use, so DOE accounted for electricity used both in the active mode and the standby and off mode, taking into account when the boiler is used for space heating and water heating. DOE took into account, based on this equation shown here, the electrical power used during the space heating and water heating, the standby, and also accounted for some adjustments in terms of the AC use because some of the heat in the condition space might be used during the non-heating season and that would impact the AC consumption.

MR. BROOKMAN: Yes.

MR. ROSENSTOCK: Steve Rosenstock, EEI.

Again, I could find it or I didn't bring those pages in the technical support document. In those situations, what kind of energy consumption are we talking about? How much -- what's the magnitude, what's the scale, what's the range in that case?

MR. FRANCO: These are fairly small, but it depends on obviously the situation, but it could be a positive to a negative effect, depending on what's your baseline, but it's about 50 to 100 -- no, it averaged about 50 kilowatt hours.

MR. ROSENSTOCK: 50 kilowatt hours a year?

MR. FRANCO: Yes.

MR. ROSENSTOCK: So, you're saying typical of a central air conditioner uses about 2500 kilowatt hours a year, central air conditioner. So, you're saying it would increase the cooling load by 2 percent?

MR. FRANCO: Sorry. This also accounts for the space heating, so a little bit of adding to the space heater, so about --

MR. ROSENSTOCK: No, I understand the electric use AC. It's just that 1 percent, so you're saying --

MR. FRANCO: Yes, it's about 50 kilowatt hours.

MR. ROSENSTOCK: Steve Rosenstock, EEI.

Again, just looking at the fractions and then you show kind of where they're installed, again I want to talk about it when we get to the assumptions because especially if they're no where near the thermostat they're not going to have any impact whatsoever on the cooling load because ^^^^ again, I don't know what the BTU output of that water heater, what the BTU losses of that water heater, but if it's only like 500 BTUs versus a cooling load of 36,000 BTUs per hour it's not going to change that air conditioning compressor use and indoor fan use -- again, in my view.

I know it gets kind of where they're located. I'm just again worried about that number being assumed that every BTU is automatically into the cooling load and they all affects the thermostat. I'm a little worried about that. Thank you.

MR. BROOKMAN: All right, Frank.

MR. STANONIK: Frank Stanonik, AHRI.

Related question, and just understand how you factored that particular energy use in, okay. So, you know let's talk about boiler installation. So, you have a certain estimate of how many boilers are not in the condition space, so they wouldn't affect the air conditioning.

When we talk about homes with boilers, there certainly is some percentage that don't have air conditioning, so how do you factor those factors into what number you plug in because I'm assuming that number gets plugged in in all cases, right? It doesn't?

MR. FRANCO: No, it's an individual case. And obviously, it takes into account where they have an air conditioner where the --

MR. STANONIK: Okay, I misunderstood. Right. Okay.

MR. FRANCO: And the 50 is just for the houses that do have an air conditioner and have these impacts applied, not to all households, just to the ones that are impacted.

MR. ROSENSTOCK: And Steve Rosenstock, EEI.

Was it different impacts for houses with room air conditioners versus central?

MR. FRANCO: That's correct. Yes.

MR. ROSENSTOCK: Okay. Thank you.

(Slide.)

MR. FRANCO: Just moving through the equations, so the burner operating hours take into account the space heating and water heating. The electrical power is of the electrical components. Some of these are according to test procedure, other comes from manufacturer literature, and we'll talk in more detail in the next slide.

(Slide.)

MR. FRANCO: We take into account again the energy use of the standby and we just discussed the cooling energy impact of this. The standby and off mode calculation is shown here as well, and basically it's the power of the standby and off mode times 876 to minus the burner operating hours of the space heating and water heating. So, let's go through the assumptions in further detail.

MR. BROOKMAN: Paul.

MR. SOHLER: Paul Sohler.

Question, when you say the definition of active mode is when the boiler is being used does that mean when the boiler is firing or is that when the boiler is responding to a call from a thermostat?

MR. FRANCO: The burner operating hours is actually when the burner is on, so when it's actually on. And just to clarify, this equation is slightly simplified. When we multiply this times the power of the electrical component, we take into account the ratio between the burner on time, so when the burner is on and when the electrical component is on.

MR. SOHLER: Sorry. I was actually asking about active mode. In other words, do you define active mode as including just the time the burner is on or is it the time that there is a call for space heat from a thermostat?

MR. FRANCO: So, for the burner operating hours is just when the burner is on.

MR. SOHLER: Right. In other words, okay, does active mode -- I guess what I'm asking is does active mode go beyond burner operating hours or is the active mode time, if you want to call that equal, to burner operating hours?

MR. FRANCO: When we do the analysis, we account for active mode and standby use. We don't differentiate. Why?

MR. SOHLER: What I'm asking is do you define active mode as -- you know is the boiler only in active mode when the burner is firing or is the active mode include the entire time -- the time the burner is on, plus any other time where let's say the target temperature has been reached. There's still a demand for space heat, but the burner is not firing. Doesn't that make sense what I'm asking?

MR. FRANCO: No, it doesn't. In terms of the equations, how we apply it we apply just the burning operating hours and then we take into account other things that are going on to the system in terms of the other components, electric use. So, how we define it in terms of energy consumption is just the burner operating hours and any adjustments to those hours in terms of the electrical components.

MR. BROOKMAN: So, Victor, the active mode powers are greater than burner on hours?

MR. FRANCO: Yes, potentially. Yes.

MR. BROOKMAN: Because there are other factors you include in active.

MR. FRANCO: Exactly, yes.

MR. BROOKMAN: Okay. That's consistent with where I thought you were going.

MR. SOHLER: Okay, let me think about that. Thanks.

MR. FRANCO: Okay. Thank you.

(Slide.)

MR. FRANCO: So, now let's look at in more detail the assumptions for electricity use. So, one of the components we consider is the primary circulating pump. Obviously, there are systems that have more than one pump. For this analysis, we considered just the primary circulating pump. And for both non-condensing and condensing units, we used the same motor type. It's PSC average 81 watts motor. DOE did not consider higher efficiency pumps in this analysis, although DOE knows that there are more efficient pumps associated with, for example, condensing technology.

In terms of induced-draft and force-draft fan, DOE derived values based on the 2013 AHRI directory. In the directory there's an induced-draft wattage that's available. It's called PE. And the values that are listed here are based on using non-condensing natural draft, non-condensing induced draft, and condensing technology. The average values we applied to all models.

It is important to note for two-stage and modulating we assumed that the reduced inducer power would be 70 percent of these values. That's mainly applicable to condensing equipment and for gas-powered hot water boilers.

In terms of ignition, we assumed that they use spark ignition for all products and the power is equal to 25 watts. In the cases when the condensing pump is present -- and we'll discuss this in further detail in the installation cost model -- we assume that the power will be equal to 60 watts.

Finally, in terms of standby and off mode, we assume that 25 percent of consumers shut off the boiler during the non-heating season. This is based on stakeholders' comments on the previous NODA analysis that we should account for a fraction that do shut it off, so we have this fraction.

MR. BROOKMAN: Steve Rosenstock.

MR. ROSENSTOCK: Steve Rosenstock, Edison Electric Institute.

Again, in terms of the pump motors, you know there's been you know movement towards UCMs and also the small motor efficiency by DOE went into effect March of this year, so you're saying you're not considering pumps with higher efficiency motors, but they are in the marketplace, so won't that have an impact; especially, starting in 2020 where the average wattage might go down?

We'll start with that one. I have a few other questions after that.

MR. FRANCO: Thank you so much for that comment. Because that just became effective. It was before we did conduct this analysis. We will take that into account for the next portion.

MR. ROSENSTOCK: Okay. Thank you. Next question I had was you said the spark ignition for all products, the ignited power of 25 watts was that also based on AHRI directory or where'd you get the 25 watts? The reason I'm asking is I just remember someone -- neighbor had a propane grill. They just replaced their AA battery for the igniter and I'm like why would you need 25 watts when an AA battery would work? So, I'm just kind of curious where'd that 25 watts come from?

MR. FRANCO: Thank you so much. We got that from manufacturers.

MR. ROSENSTOCK: Manufacturers? Okay. And the pump, again, that's 60 watts is from the manufacturers?

MR. FRANCO: This is actually from manufacturer literature of pumps, related to pumps for two or three pump models.

MR. ROSENSTOCK: And Steve Rosenstock, EEI.

What was kind of the range and some of the values for the condensate pump or the ignition or the pump motor? What kind of range did you see, just out of curiosity, range of wattages?

MR. FRANCO: Pumps were around -- well, the ones that we considered were for like an average use and it was about the 60 watts.

MR. ROSENSTOCK: 60 to 100, maybe,

something for the pump, for the primary pump.

MR. FRANCO: It could be a little bit lower than 60, but yes.

MR. ROSENSTOCK: Okay. Okay. And what about for the ignition of the condensate pump, what kind of range did you see?

MR. FRANCO: For the ignition, that's the only value that we have.

MR. ROSENSTOCK: That's the only value? Okay. And how about the condensate pump?

MR. FRANCO: That's the one that I mentioned, the condensate pump.

MR. ROSENSTOCK: Okay, the same with the ignition, you just had the one value?

MR. FRANCO: We had two or three values.

MR. ROSENSTOCK: Two or three? Okay.

MR. FRANCO: Yes.

MR. BROOKMAN: Joanna.

MS. MAUER: Steve, you were mentioning the small motor rulemaking. I don't think the small motor rule affects any of the motors used for circulating pumps.

MR. BROOKMAN: Yes, thank you. Frank.

MR. STANONIK: Frank Stanonik, AHRI.

Victor, on the information here for the oil-fired products, okay, so every oil-fired product uses some electricity in the burner to essentially atomize the fuel, right? So, the natural draft oil-fired you have a certain number there, which would be let's say the standard oil-fired boiler. So, now if you add that other component, which would be the draft inducer, which is totally independent of whatever is happening with my burner, shouldn't the total watts of the non-condensing induced-draft model be higher not lower?

This is saying that the wattage usage for I'll call it standard oil-fired product is 236 and yet, if I add the feature of another component, electric-using component, which would be the draft inducer, my total wattage usage goes down. Something seems to -- I'll defer to the people who make the oil boilers, but it doesn't seem right, though.

MR. FRANCO: Thank you so much for that comment. We would appreciate feedback on that.

These are averages that are in the AHRI directory. There could be other things going on in terms of the burner, in terms of the induced draft, and we would be taking a look at that in more detail in the engineering analysis to help determine what actually going on.

MR. BROOKMAN: Gary.

MR. HAINLEY: I can comment for any -- Gary, U.S. Boiler Company.

I can comment on our products with induced draft oil that the burner is the same, whether it's an induced draft or an atmospheric vented product. So, I would agree with Frank's assertion that that number for induced draft should be at least equal to if not higher than the atmospheric vented product.

MR. BROOKMAN: Okay. Thanks Gary. Let's press on here, Victor.

(Slide.)

MR. FRANCO: Thank you. So, going into more detail in terms of the induced draft, this is going to be important in terms of the installation costs, which we will be talking about in a little bit.

We came up with fractions of models that have induced or forced draft based on the 2013 AHRI directory. So, this slide shows those fractions. So, for a gas hot water boilers, 82 percent there about 22.25 percent. If you go to 85, they're about 63 percent. And we did the same for all the products. We'll get back to these fractions when we talk about installation costs, but this is just to highlight this in terms of energy use.

(Slide.)

MR. FRANCO: The next slide shows the final results in terms of the annual energy consumption savings in terms of the active mode or AFUE standard for the four products being considered -- four classes being considered for each of the efficiency levels. So, you can see the fuel energy use savings and electricity consumption savings.

MR. BROOKMAN: Yes, Rick.

MR. MURPHY: Rick Murphy, AGA.

Victor, I'm assuming that the annual MM BTUs for gas boilers is a weighted average based upon the distribution of where the boilers are currently in place today.

MR. FRANCO: That is correct.

MR. MURPHY: Okay. Thank you.

MR. BROOKMAN: Yes, Gary.

MR. HAINLEY: Gary Hainley, U.S. Boiler.

Back to the previous Slide 60, just to clarify that you looked at fraction of models in the AHRI directory that's not -- just to confirm not sales, but just listed models.

MR. FRANCO: That is correct. Yes, those are listed models. And we would really appreciate to match that to shipments in this analysis. We assume that the models would be similar to shipments.

(Slide.)

MR. FRANCO: This next slide provides the same results for the standby in terms of electricity consumption, and you can see the same exact.

MR. ROSENSTOCK: Steve Rosenstock, Edison Electric Institute.

I think here and also in the technical support document EL3. I think there's a math error there in terms of your savings.

MR. FRANCO: That is correct, yes.

MR. ROSENSTOCK: I think it should be 19.6 or 19.7 kilowatt hours for that EL3.

MR. FRANCO: Yes, that is correct. Thank you so much for bringing it up.

MR. ROSENSTOCK: Steve Rosenstock.

Again, just looking at this -- and again, you were talking about kind of a -- well, I haven't really divided it. When I'm looking at this, again also thinking about the boiler operating hours, it looks like it's the -- like for EL3 it's the full almost 2 watts of savings based on I'll say 8100 hours of operating in standby. So, it looks like -- again, I had to dig through I guess a little more, but again, it seems like when you talk about the wattage savings it does look like for this characterization that if it gets you know put in for the full analysis of the national impact it does look like it's the full I'll say 2 watts savings at EL3. It does look that way based on my -- again, I'm just trying to match up all the numbers and calculations, so it might be a little overstated. Thank you.

MR. FRANCO: Thank you. So, this concludes the energy use characterization. And let's look at some comments.

So, we request comments on using RECS and CBECS data for calculating energy consumption, both water heating and space heating. We request comment on the fraction of boilers that are used in commercial applications. We're 7 percent. We also request comments on the approach for adjusting AFUE based on the field considerations for automatic means, jacket losses, return water temperatures. And we also request comment on the fractions of installations of low temperature and high temperature.

MR. BROOKMAN: Comments here? John? No?

(No response.)

MR. FRANCO: And next, DOE requests comments on the fraction of boilers that are used for domestic water heating. We request comment on the fractions that are installed with draft inducers, so that would be shipments by efficiency level. DOE also requests comments on the 25 percent assumption used for the boilers being shut off during the non-heating season. And we invite any other comments associated with energy.

MR. BROOKMAN: Frank Stanonik.

MR. STANONIK: Victor, one of the things in looking -- you know you mentioned the use of the RECS data, and on Slide 50 it says that it references RECS 2009. and it indicates that the total number of buildings that would have a gas product -- and again, I'll just use that as an example -- either hot water or steam comes out to be about 10.5 million. And I didn't bring my whole copy of RECS with me, but the excerpt I had indicates that number is at least that chart -- I'll send it to you, but indicated the total was only about 8.6 million buildings that either had a gas, steam or hot water.

I guess we need to get that settled because obviously if, taking my viewpoint, if you're 10 million and ^^^^ a half numbers high then you know by a factor of 25 percent overestimating the savings benefit because there's not that many buildings that have boilers. I'll send you what I'm looking at. You know RECS numbers are RECS numbers, right? Either I'm looking at the wrong chart or something got slipped here.

MR. FRANCO: Thank you so much, Frank. Let me just explain a little bit what these numbers represent. So, the first row, which is hot water gas boilers, is actually all the samples that have a gas and that we consider based on the criteria that they have a boiler. That's the number.

The steam boiler is actually a subset of that number, so we're actually using only six million buildings that we think that have a residential boiler and that would match up to your numbers a little bit better. So, don't add up those two numbers. The whole sample is what we're using for the hot water boilers.

MR. STANONIK: Okay, Victor, now be careful because if steam is a subset then -- you know we know that they're selling a whole lot more hot water boiler than they're selling steam boilers. Again, we'll look at that, but I think there's more

-- I think today we have more hot water boilers installed than steam, but your numbers would say two out of three are -- based on the count two out three are steam and that's off.

MR. FRANCO: Probably it would've been better to use the -- actually, these numbers that we're using in terms of the weights that we used in our analysis are provided in Table 7.2.1 and beyond. The first column is just the RECS weighting and the next column is actually the number of boilers, sort of our weighting based on whether it's a replacement or a new construction.

And for example, for gas-fired hot water boilers we assume that that represents four million. And for gas-fired steam boilers that represents .4 million, so that's 10 times more for the steam.

MR. STANONIK: I stopped looking at that table, okay.

MR. FRANCO: Yes, sorry about that.

MR. BROOKMAN: Take a peek at these request for comment boxes, see if we have any additional comments here, and also acknowledge the offer from Frank and I think also Gary to see if they could come up with some additional data, some additional shipments data. Steve comment here?

MR. ROSENSTOCK: Yes, again, Steve Rosenstock, EEI.

When you say that they're "shutting off the boiler," for those that are not doing hot water heating so it really doesn't go off, you know it's springtime and summertime and they set the thermostat -- you know if they have a common thermostat it's set to air conditioning. How would the boiler be on, or if they have this room air conditioner? The air temperature boiler never comes on. How is I'll say not shut off?

I guess I'm a little loss here. I know there's some electric standby, but in terms of I'll just say the main boiler function is you know after a certain day in the spring when it's warm enough the boiler really isn't going to come on. Yes, no one has pushed a switch, but how is it "not off" for the warm weather?

MR. FRANCO: So, obviously the standby is this value that even though it's not operating there's still this standby. We assume based on some input that there were some situations where people might unplug the appliance or do something else and that this would be this 25 percent.

MR. ROSENSTOCK: And Steve Rosenstock, EEI.

There aren't any boilers with I'll say like shutoff valves or anything?

MR. FRANCO: Not that we are aware of, but we requested from manufacturers if that's the case.

MR. BROOKMAN: Yes, please, Gary.

MR. HAINLEY: Gary Hainley, U.S. Boiler.

Just to summarize a comment I made earlier about low temperature versus high temperature applications, I think the data that was presented overestimates the number of low temperature systems out there, that the majority of the systems out today for replacements are going to be high temperature, high-end homes. Certainly, there are going to have low temperature systems with radian in bathrooms and kitchens, et cetera, but that's a small percentage.

And the second comment is on the fraction of boilers that require draft inducer by efficiency level, and I think it's our contention that as you get 84 or 85 percent if that became a federal minimum that that starts to drive the inducer percentage almost to 100 percent for a gas water boiler just because chimneys aren't functional in a broad sense at that point. Thank you.

MR. BROOKMAN: Thanks. Look at the request for comment boxes on your sheet, please, both 4-2 through 4-9 and see if we have anything additional at this point. Joanna.

MS. MAUER: Gary, if I can just ask you a question about your last comment on inducer fans. Are you saying that the portion of shipments is at 85 percent those inducer fans would be higher than the portion of models at 85 percent with inducer fans? I guess it looks like DOE collected data on all available models and whether they have an inducer fan or not. And I think for gas hot water they're showing 63 percent would have an inducer forced draft at 85 percent AFUE.

MR. HAINLEY: I think that the shipments -- Gary Hainley, U.S. Boiler.

My comment was more specifically if the proposed rulemaking went into effect that it would drive a higher percentage of inducer fans, but I do believe that for both atmospheric and for induced product today that shipments will be different from the models listed in the directory. I can't comment on whether that percentage of models matches shipments or not.

MR. BROOKMAN: Okay, Frank.

MR. STANONIK: Frank Stanonik, with AHRI.

But Joanna, I think looking at it maybe a little bit differently, yes, we would expect a huge percentage of models would now have to have that draft inducer and so that, in fact, it would be likely that even in terms of shipments you know the shipments of actual units with draft inducer because now you know not even in most. We're talking you know probably 70, 80 percent or whatever you know that were to go up because that's what would be available.

You'd certainly flip the current situation where there's probably more models without inducer motor -- yes, draft inducers on them at the 80 percent level or whatever and that would certainly flip. Whatever the percentage might be, without question, the actual shipments of models with draft inducers would go up a lot.

MS. MAUER: I mean I think DOE is capturing that to some extent.

MR. STANONIK: I think it's going to be higher than that even.

MS. MAUER: Okay.

MR. BROOKMAN: Additional comments here? We're about to break for lunch. We're at a natural break point. Let's pause for lunch. It's now almost 12:25, so let's break for an hour, which means we'll resume at 1:25.

(Whereupon, a lunch recess was taken at 12:25 p.m.)

MR. BROOKMAN: Hope you all had a nice lunch. We're going to pick up where we left off on life cycle costs and payback period analysis, and back to Victor.

MR. FRANCO: Thank you. Welcome back. This is Victor Franco again. We're going to next be talking about life cycle cost and payback analysis and at the end subgroup analysis in this section.

(Slide.)

MR. FRANCO: This first slide shows the flow chart of the analysis input for the life cycle costs and payback period analysis. The two yellow boxes show the end result to payback period and life cycle costs. We consider the total install cost incremental. That's the top portion. We've gone over markups, which is part of the consumer prices. We'll talk a little bit more on consumer prices and installation costs.

The bottom portion shows the annual operating cost savings, which are also an input. Those also have the annual energy costs, and we discussed energy consumption related to that, and we'll talk about all these parameters in more detail in the next few slides.

The last component that's important that we'll be discussing is the base case efficiency distributions.

(Slide.)

MR. FRANCO: This next slide provides a little bit of an overview about the life cycle costs. So, just as a reminder, the purpose of this is to do an economic evaluation from the residential consumers' perspective and this is over the lifetime of the equipment. The method and the equations are available down here. And just the last thing to point out is we model this using certain variability inputs using Monte Carlo approach and so a lot of the inputs that we'll be using our hard lay distributions using an Excel spreadsheet, which is available for the public to take a look at.

(Slide.)

MR. FRANCO: This next slide provides an overview of all the inputs that we'll be discussing, so it basically has a basic purpose definition and more or less a summary of the methodology, so I won't be going through this, but this might serve as a good -- going back to and seeing the different inputs that we're talking about.

So, I'll go through these in order. So, first, we'll start with the consumer product price. So, the consumer product price is the manufacturing costs times markup times sale taxes. We already discussed markups and sales taxes and manufacturing costs previously.

The only topic we haven't discussed here is we have a product price trend based on historical PPI data. For this product we looked at the PPI data and found that there wasn't much of a trend, and so we assume a constant price trend for this. We would request any data that's available.

We do have two scenarios that we look at. We look at a decreasing and an increasing. And the results are provided the MIA analysis in chapter 10.

MR. BROOKMAN: Steve.

MR. ROSENSTOCK: Steve Rosenstock, EEI.

Especially for some of the newer people this is real prices, not nominal. This is real. So, when you're showing this graph of price factor index for your one that I'll say both increasing or decreasing it looks by 2048 it's a 60 percent real price increase versus about a 40 percent real price decrease in your sensitivity analysis, and that's over and above inflation. Correct? That's a real. Thank you.

MR. FRANCO: That's correct. Thank you for that.

So, the next component of the total install costs are the installation costs. These are about 14 to 15 slides that we'll be taking a look at carefully on the installation cost, and I assume you'll have comments and questions, so we'll go through this in a little bit more detail.

(Slide.)

MR. FRANCO: This first slide provides, more or less, a general overview of the installation cost model. We take into account three basic components in terms of the installation costs. The first one is the basic installation cost. I'll be describing those in more detail in the next slide. Then we take into account venting costs, both for non-condensing and condensing boilers, and we'll be talking in a few slides about that. And for condensing equipment, we take also into account condensate withdrawal installation costs.

It's important to note that these costs are for the individual households, so any value that I've provided are average values, but we do have a value for each household that's specific for that household and that installation location. So, in that regard, we'll be starting in terms of looking at the installation location, which is an important component of this model.

The last thing to point out here is the sources. We use 2013 RS means, residential and mechanical cost data. We also based some of our assumptions and data based on the 2007 furnace and boilers final rule and 2011 direct final rule for furnaces as well as manufacturer literature.

(Slide.)

MR. FRANCO: So, this slide shows the determination of installation location, the assumptions based on RECS 2009 housing sample. RECS does not provide the exact installation location where these boilers are located, so we have to make some assumptions where we might think the boiler is installed.

Since many boilers are installed in basements, we assume that if the household has a basement it will be installed in the basement. The RECS does report if the basement is finished or conditioned or unconditioned, so what we do differentiate between conditioned and unconditioned basements.

We next take a look if the household has a garage. If the household has a garage, we assume that it's in the garage. And if it doesn't have any of those, we assume that it's in another location indoors.

The fractions of installation based on these assumptions are reported here. So, for gas boilers, 35 percent are in conditioned basements, 27 in unconditioned basements, 8 percent in garages, and 30 percent in other indoor locations and the similar values are for the oil boilers as well.

MR. BROOKMAN: Steve.

MR. ROSENSTOCK: Steve Rosenstock, EEI.

When you're saying other indoor locations, what part of the house would they be placed in? Are you assuming that they would be on the first floor or second floor? I'm just kind of curious. It says other indoor, and I know that some of that's just commercial buildings, but I'm just saying for those residential locations would that included an occupied floor and an attic? I'm just trying to get my arms around what -- you know when you say 30 percent that is significant. I'm just kind of curious where the assumption would be.

MR. FRANCO: Yes, that's a very good question. We do actually assume that a fraction do go in the first floor. The locations would be kind of like in a closet area, kind of like maybe a utility room, but it's kind of indoor location inside the building that's connection -- more connected to the building. There's a fraction that we assume that are potential on the second floor if the household has a second floor.

MR. ROSENSTOCK: Steve Rosenstock, EEI.

Other indoor conditioned space is what the analysis is considering, right?

MR. FRANCO: That's correct. Yes, that's correct.

MR. ROSENSTOCK: Okay. Thank you.

MR. BROOKMAN: Paul.

MR. SOHLER: Paul Sohler.

If there's a garage and a basement, you're assuming the boiler is where, in the basement?

MR. FRANCO: So, first consideration is the basement, yes.

MR. SOHLER: The other thing, and I think this maybe comes back to the previous section, but you know I think it's been kind of a longstanding assumption that a boiler in a basement the heat that's lost from it, whether it's -- not really differentiating between whether there's radiation in it or not, is considered useable energy because it's going to tend to rise through the house. So, I'm a little lost as to why you even need to consider you know the losses out of the jacket of the boiler really, which you've done previously and I guess it you know loops back into here for differentiating.

MR. FRANCO: That was our assumption that since it was unconditioned for a lot of this it might not trickle up. It would be good if you could provide feedback on that so that we could make the proper adjustments.

MR. SOHLER: All right, we could provide feedback, but I think, like I said, there is an understanding -- well, actually, in 103 nowhere else -- I mean it's not -- something I think you guys kind of have access to if you look at you know indoor boilers. In EISA 103, you do not measure jacket loss; yet, you seem to be assuming that there is jacket loss there, which kind of contradicts the standard that you know using.

MR. FRANCO: Yes, our understanding is that there are some situations where the boiler is kind of -- it's not directly impacting the heating of the household because it's kind of in a space that's not directly connected to the house. Those losses may be different from what we're assuming, but we assume that there's a certain fraction. We would appreciate your comments if those are -- if that's not appropriate.

MR. SOHLER: So, you're assuming, as I read this 27 percent of gas boilers are installed in a place where the jacket loss is of no use to heating the building is what this is saying.

MR. FRANCO: Correct; 27 plus the 8 percent for gas, so that's what we looked at before, which is the 35 percent. This has implications in terms of the installation as well because we'll be looking at other factors that play into this.

MR. BROOKMAN: Yes, please, John.

MR. RODER: John Roder from Burnham Holdings.

There've been a number of occasions where we've been asked to provide more data. And I was just wondering; John, will that be taken into consideration with respect to the extension that's been requested? I understand now it's also formalized.

MR. CYMBALSKY: We'll take data at any time during this process, so a good way to give data, particularly, business-sensitive data is through the NDAs with our consultants. You can do that at any time during the comment period or out. We will consider it as much as we can in the analysis.

MR. RODER: But we have a hard date to get written comments back to you, and that's got to be the priority unless you give us a little latitude on that.

MR. CYMBALSKY: Right. So, like I said, DOE's considering the comment extension. I could say that we will grant some period of time. I can't tell you the number of days, but I can say confidently we will extend it. It's hard for me to sit here and tell you how to prioritize what you what to give us. From a selfish point of view, the numbers are really good for us, but your concerns are obviously very important to you on the rules. So, we want everything, but again, if the numbers come later through the NDAs we'll take it. You know but at some point we're going to go forward with what we have.

MR. RODER: Okay. All right. Thank you.

MR. CYMBALSKY: Fair enough?

MR. RODER: Yes.

MR. BROOKMAN: Steve Rosenstock.

MR. ROSENSTOCK: Steve Rosenstock, EEI.

I'm also again kind of interested -- again, I know you've looked at the RECS data a lot more than I have. In terms of the homes with I'll say unconditioned basements and garages, is there also data in there in terms of tying them into homes that also have either room air conditioning or no air conditioners versus central systems?

MR. FRANCO: Yes, that is correct.

MR. ROSENSTOCK: Is there a good correlation the higher percentage in unconditioned basement the more likelihood its room air conditioner or no air conditioning?

MR. FRANCO: No, I don't have that data.

MR. BROOKMAN: Rick.

MR. MURPHY: John, just a follow-up question to the point on incremental data, I would assume it's depending upon the level of data that's shared. But based upon data that is provided, would DOE re-run their spreadsheets and re-publish those that would then become available for review again?

MR. CYMBALSKY: You know I can't say one way or the other at this point until -- those decisions are made based on what we get, but at this point, no, we plan on going final after this unless there's a reason to do something different.

(Slide.)

MR. FRANCO: So, next, I'll be going into more detail into these three installation components. So, first, let's quickly go into basic installation costs. So, the basic installation costs include the following. A trip charge in case of replacements, removing of old boiler in case of replacements, placing and set up the boiler, circulating pump, installation gas and oil piping, water piping, electrical hookup to a thermostat, and permanent and removal of disposal piece.

The basic installation costs are the same throughout for all the efficiency levels. That's we call them basic installation costs. These do not include any adjustments to the distribution itself. So, in our analysis, we consider that the distribution is not impacted and that's why we decreased the efficiency of, for example, condensing boilers.

In terms of the overall average basic installation costs, the numbers are provided in this table. They're about 2,700 for gas-fired hot water boilers. And again, these take into account geographical location as well as the installation location and installation time, whether it's residential or new owner or replacement.

Next, we'll take a look at the venting installation costs. So, there will be quite a few slides regarding this.

(Slide.)

MR. FRANCO: In terms of the venting installation costs, we take a look at cost related to non-condensing boilers, which might include chimney re-lining, metal vent modification, metal vent also for new construction, and stainless steel venting. So, we'll go into these in more detail in the next few slides.

(Slide.)

MR. FRANCO: For condensing boilers, we're talking a look at new PVC venting, orphan water heaters potentially, combustion air direct vent installation costs, and also concealing pipe replacement.

(Slide.)

MR. FRANCO: One of the major components of the venting is the venting length. Here's the methodology that we used, all the different inputs we take into account and a floor chart. First, we consider whether it's a vent vertical length or horizontal. Typically, in non-condensing this would be a vertical, a stainless steel or PVC piping for condensing would be a horizontal length.

In terms of getting the actual distance, we come up with all these different components, including the ceiling height, the floor height, if the household has a cathedral ceiling, number of floors above the boiler, and whether it has a horizontal distance as well and that goes into the vertical length.

In terms of the horizontal length, we take into account where the boiler is installed, assume that the boiler is installed somewhere. On average, it will be installed in the middle kind of the household, so that would be the average length diagonally. And in some situations, it might be able to vent directly through a wall, so it might be a short length. In other situations, it might be all the way at the other side of the household, diagonally, which would be the maximum distance. So, for each household there's a distribution that's applied and that takes into account the average wall length and average horizontal to vertical vent ratio.

MR. BROOKMAN: Rick.

MR. MURPHY: rick Murphy, AGA.

Victor, I didn't see any costs associated with the relocation of the boiler. Does that assume that that would never take place?

MR. FRANCO: Yes, this analysis does not assume any relocation of the boiler. This assumes that it's in the same location. And the venting is what actually travels a distance to wherever it needs to be vented. So, let's say you have a situation non-condensing where you're venting vertically at a certain location in the building and you can't vent through the wall that's closest to the boiler. And so, you don't move the boiler, but you do have to vent through for say, for example, the other side of the room and so we consider the cost of having the vent go through that wall on the other side.

MR. BROOKMAN: Yes, Paul. Roger.

MR. MARRAN: Roger Marran.

I just wanted to add onto the vent cost. So, when we look at installations that are for wall-hung boilers, oftentimes the original boiler is free-standing in the middle of the basement, for example, and they'll have to move the boiler to the wall. Sometimes they have to build a wall. They definitely have to re-pipe some of the piping to get over there, so there are additional costs considerations that maybe additional there. I'm not sure if that's incorporated as well.

MR. FRANCO: Thank you for that comment. No, we didn't actually apply it that way, but that would be good if you could put that into a written comment. That's something that we could consider actually moving the boiler in a situation and then having to do re-piping.

MR. BROOKMAN: And Roger, if you have any estimate of costs also that would be very helpful. Yes, Paul.

MR. SOHLER: Paul Sohler.

The orphan water heater issue, if I'm understanding this correctly, was not considered in the non-condensing boiler levels?

MR. FRANCO: In terms of stainless steel, it is considered. So, if you had to do a stainless steel that would be an orphan water heater. Yes, it's not listed here as a specific. Sorry about that.

MR. SOHLER: Okay.

MR. FRANCO: And we'll go into that in more detail in the next slides.

MR. SOHLER: Thanks.

(Slide.)

MR. FRANCO: So, let's go into more details in terms of looking at the case where we're doing a replacement case, non-condensing to non-condensing. So, we have a few considerations. First, depending on the input capacity we assigned 2 inches to 6 inches, depending on the vent size, depending on the input capacity of the boiler. We have fractions based on data from 1990s about the fraction of units with a masonry chimney. Of these we assume that a fraction require re-lining. If the household has a chimney and the boiler is installed before 1995, we assume that it has to be relined.

In terms of venting re-sizing of vent connectors that might be required, first, we consider whether the chimney has been relined. If it hasn't, then we might consider vent re-sizing. To consider the household to be re-sized, in terms of the venting, the house also has to have an existing natural draft boiler and the last boiler replacement has to be before 2020. We base the efficiency of the boiler based on the RECS data about the boiler age vintage and the historical shipments data provided by AHRI.

The last piece of the non-condensing to

non-condensing is the stainless steel venting. We assume that half of the fraction of the models that we previously reported would require the households to install a stainless steel, new stainless steel venting. So, for 82 percent at hot water, gas water, there were 22 percent of the models had an induced or a forced-draft fan. We assume that 11 percent of those then would have to install a new horizontal stainless steel vent.

Similarly, for the 85 percent, we assume half of the previous fraction, so 83 percent was from 32 percent had to do this vertical venting. When you do this vertical venting, obviously, you have to -- and you're doing a Conley vented with the water heater you come into a situation orphan water heater. So, in the situation where you have this stainless steel, vertical -- horizontal venting we do take into account orphan water heater.

MR. BROOKMAN: Paul.

MR. SOHLER: Paul Sohler.

I would take serious issue with the statement that -- or the assumption that the masonry chimney requires re-lining if the boiler was installed or the building built before 1995. It is true that the National Fuel Gas Code does require re-lining of some chimneys and then generally outdoor ones, but if you've got an indoor terracotta chimney that's correctly sized there is, in a lot of cases, no reason to reline it. That seems to be kind of a built-in assumption that you're going to do that no matter what type -- what efficiency level you have and I do not think that's correct.

MR. FRANCO: Thank you for that comment. So, just to emphasis, we're assuming that building build after 1995 would meet the fuel code, so those are okay, right? You agree that those --

MR. SOHLER: Agreed.

MR. FRANCO: Those would be okay? Now, the boilers that might be installed after 1995 what you're saying is that a portion of those might not be relined?

MR. SOHLER: No, I'm saying the ones built before 1995, a lot of those will not need to be relined. The assumption you're making that they all will need to be regardless of what you know tech level you go to.

MR. FRANCO: Yes, as we'll see, the fraction is fairly small due to the fact that a lot of boilers have been installed after 1995, so if the boiler has been installed after 1995 -- between 1995 and 2020, which is a large fraction of the boilers, 2020, that there won't be any chimney re-lining in our analysis.

MR. SOHLER: Okay.

MR. FRANCO: We'll go into those fractions in the next few slides.

(Slide.)

MR. FRANCO: So, now let's briefly go into the non-condensing to the condensing situation. So, in the non-condensing to condensing situation, you have to look at replacing the metal vent with PVC flue vent. In terms of the materials, we assume a certain fraction are PVC or PP, polypropylene and a certain fraction are CPVC installations.

(Slide.)

MR. FRANCO: The venting also is between 2 inches and 3 inches. The fractions are provided here. Again, we take into account several installation locations in terms of what the venting length will be. We take into account the wall types that the penetrations will have to go through and the vent determinations are also taken into account. In addition to this, there's a cost added for the air combustion vent for direct vent installations. The fractions are provided in chapter 8 appendices for installations.

Further, there's also an additional costs for concealing vents in indoor installations. So, for the fraction of installations that are indoors there might be a cost for actually concealing the vent piping. Say, for example, you have to go through a living space and you don't want to have the piping through there, so we add a cost for concealing that.

The last we've discussed briefly for the stainless steel is the orphan water heaters. So, that's the case where you're venting the water heater together with the boiler. And when you're installing that either stainless steel or the PVC venting for the condensing equipment, you'd have to disconnect that. In that case, there might be a situation where you might have to reline the chimney, re-size the venting, and we do take that into account.

MR. BROOKMAN: We have a comment from someone online. Mike McDonald says one other consideration is that not all installing contractors offer chimney re-lining. This can be a problem with 85 percent non-condensing boilers. This can also limit the choices that a consumer has when choosing an installer.

MR. FRANCO: Thank you for that comment.

(Slide.)

MR. FRANCO: Next, we'll be talking about the fractions.

MR. ROSENSTOCK: Steve Rosenstock, EEI.

When you talk about concealing vents in indoor location, vent pipe concealing wouldn't that be tied into the current location of the boiler, like if it's in a basement would you really need to conceal it?

MR. FRANCO: Often in the basement not unless you're going through the condition space. So, for example, if you have a game room or something --

MR. ROSENSTOCK: Gotcha.

MR. FRANCO: -- or a living area and you have to go through there.

MR. ROSENSTOCK: Thank you.

MR. BROOKMAN: Yes, Frank.

MR. STANONIK: So, Victor, so you're assuming 75 percent of installations would use a 2-inch PVC or polypropylene. And I don't know the exact number. I'm sure we can dig it up, but when you get to a certain input level the standard PVC pipe won't be 2 inches. It'll be 3 inches. My guess right now it isn't that much pass the baseline unit. The baseline unit is 100,000, right? And so I think that the 75 percent estimate that they're going to have 2-inch PVC is probably a little high. I think it's going to be more that have a larger and then more costly because it's going to be 3-inch. I don't think you would ever run into any 4-inch on a residential, would you? No?

MR. BROOKMAN: Yes, Paul. Paul wants to follow on.

MR. SOHLER: The short answer is yes. When you get up to the upper 200 -- you know close to the upper limit of a residential range you do run into boilers with ^^^^ condensing boilers with 4-inch vents.

MR. BROOKMAN: Okay.

MR. FRANCO: Thank you. I appreciate that. And you can have that in written comment that would be better.

(Slide.)

MR. FRANCO: So, the next two slides provide the fractions that we are applying, so they're kind of a little bit of summary in terms of both the fractions and the installation costs. So, I'll go fairly quickly through the fractions, and these are all provided in the appendices to chapter 8.

So again, we consider the cases where we're going from a non-condensing to a non-condensing situation. And we're accounting for unlined chimneys, re-lining those, installing new vent connectors, re-sizing the vent system. And these are the fractions that we applied to the appropriate installations that might require this, and we also apply stainless venting. We do the same for the condensing, and here are the different fractions, especially for the orphan water heater situation. The next slide will actually provide the costs that were associated in the fractions. So, let me go to the next slide.

(Slide.)

MR. FRANCO: So, this slide provides the cost for just the non-condensing hot water gas boiler installations, but obviously, we did this for all the different product classes. So, in terms of vent re-sizing for 82 percent we assume that .3 percent need a vent re-sizing, 2.2 percent need a vent connector, 5.7 percent need chimney re-lining. And again, we're applying these fractions with new stainless steel venting 11 percent. So, this is the overall fraction of installations that when you're going from non-condensing to non-condensing would require some vent modifications at 82 percent.

(Slide.)

MR. FRANCO: The other fractions for the other prior classes are provided here. The last four rows provide the average cost, so again, this is an average cost. When we apply this to a specific household the range is pretty wide in terms of the actual costs. So, in terms of vent re-sizing and chimney re-lining it's about $1500. The vent connector would be about a little less than $300, and a new stainless steel vent, which again, horizontally, would be around $500.

When we put all this together in terms of doing this by efficiency level, we come up with these additional costs. So, at 82 percent the average cost -- so, for all households if we average them altogether is $159 due to the venting. At 85 percent the cost is 238, so the differential would be those two.

MR. BROOKMAN: John.

MR. RODER: John Roder, BHI.

Is that for just the materials, or is that labor and materials?

MR. FRANCO: This includes labor and materials for the venting, so this includes the stainless steel vent, for example, and also the labor required.

MR. RODER: Okay.

MR. FRANCO: And again, the details are provided in the appendices.

MR. BROOKMAN: Rick.

MR. MURPHY: Victor, when you do consider or take into account orphan water heaters, in 100 percent of those instances are they doing the appropriate venting installations to retain that water heater, or do you account for any water heater switching?

MR. FRANCO: No, for this analysis we don't account for any water heater switching. We assume that they have to do a re-lining of the water heater.

(Slide.)

MR. FRANCO: So, the next slide provides a similar cost in fractions data for going from a non-condensing to a condensing situation. The fractions and the costs are both for gas-fired and oil-fired hot water boilers. Those are the only two prior classes I have condensing efficiency levels.

So again, the first column lists the fraction of installations t hat this would be applicable to and the average cost. So, this again is an average cost. The weighted average cost would be essentially multiplying the fraction of installation to the average cost and that would be $776 of installed cost for installing the gas-fired hot water boiler in terms of venting costs and the similar situation for oil-fired hot water boilers.

(Slide.)

MR. FRANCO: so, now moving onto new construction and new owners, so new construction is applicable to oil-fired and gas-fired hot water. We assume that steam there are no new construction. For new owners, it's just for hot water gas boilers. And again, new owners in this analysis is just for people that don't have previously a boiler.

So, these installation costs include

adding the new flue vent for non-condensing boilers, so it includes either a metal vent and a fraction that will install a stainless steel vent. For condensing gas boilers we have PVC, new PVC vent, combustion air vent, direct vent installation. This says PVC, but this includes the other venting types, the similar fractions -- venting material. Sorry. And we also account for commonly vented water heater, what would be the impact in terms of the costs as we're looking at the next slide.

(Slide.)

MR. FRANCO: So, in terms of the condensing boiler, the venting installation costs with the water heater we added half of the venting costs of the water heater, and we'll see this in the next slide.

(Slide.)

MR. FRANCO: So, the next slide, again this is just for new construction and new owners. And this is just for gas-fired and oil-fired. We have the metal vent system and the stainless steel vents. Here are the fraction that we assume have a metal vent and the fraction that have stainless steel, and the average costs of weighting these two is the last column. So, on average, we assume that the total venting is about $1600 for gas-fired at 82 percent and $2000 for oil-fired hot water boilers.

(Slide.)

MR. FRANCO: Next, we considered the condensing boiler installation costs. And again, the first column is the fraction, the next column is the average cost, and at the bottom is the weighted average of these two.

Just to point out, we have, for example, orphan water heater assign 20 percent. Half of the cost of the venting for that is 446. So, it's included in the 717.

(Slide.)

MR. FRANCO: So, moving from the venting costs, we go into condensate withdrawal. So, this flow chart goes over a little bit the overall condensate withdrawal methodology. We take into account the condensate pump, so we apply that to all condensing installations. We also take into account for a fraction of the time the condensate neutralizer. For units that's applicable we take into account the condensate pump, and for some of those we take into account the electrical outlet.

So, for some of these equipment there might not be an extra outlet for the plug in the condensate pump, so we assume that 50 percent of the time they'll have to install an extra electrical outlet.

MR. BROOKMAN: Frank Stanonik.

MR. STANONIK: Victor, I'm going back one slide. Showing in your new construction slide -- in your new construction slide, you're estimating that only 60 percent of the condensing boiler installations in new constructions would use a combustion event. So, based that only 60 percent would go to what we'd call a two-pipe system, what's the basis for -- why 60 percent?

And we will certainly see if we can come up with a number that has you know some relevance or some validity, but I mean my experience would say if in a new home they're going to install a condensing boiler and they are going to go sideways that they're going to give you the two-plate system, so you're talking both your combustion air from outdoors and your venting outdoors, obviously. So, what's 60 percent?

MR. FRANCO: Yes. Thank you so much for that comment. That's actually something that we want to get input on. So, if you go to Appendix 8C, there's a Table 8C.2.8, which is the fraction of direct vent condensing boiler installations. Based on the interactions with the consultants, we came up with fractions based on installation location. You don't have the table probably in front of you, but for a basis we assumed 50 percent would require direct vent installations, for garage is 90 percent and for indoor 67 percent. If you multiply that times the installation of fractions previously, you would get the 60 percent. Obviously, if you have any feedback on those fractions that would be really appreciated.

MR. BROOKMAN: Yes.

MR. RODA: Victor, just going back to the categories of installation locations and the condensate, just wondering is there any cost associated with condensate management from a freezing standpoint particularly in unconditioned spaces?

MR. FRANCO: So, in this case we assumed that it's in the location where there is no issue regarding freezing even though it's in a non-conditioned basement. Usually, it will be above freezing, but if there's any feedback or data on that. We assumed that there isn't in this analysis.

(Slide.)

MR. FRANCO: Okay, so the next slide shows the fractions again and a little bit more of a description of each of these components with the condensate withdrawal. The bottom part again shows the fraction of installations that are impacted. So, for example, we assume 18 percent would require condensate pumps, so that takes into account in new construction wouldn't apply or new owners. And the average costs are also provided. So, on average for gas-fired hot water boilers, the average cost is $98 that's added.

(Slide.)

MR. FRANCO: So, putting all this together this next slide comes up with the average total installed costs results. So, the total install cost includes the consumer prices, the installation costs, and the total cost is provided here as well as the incremental.

(Slide.)

MR. FRANCO: So, moving on from installation costs, now we're going to be talking about energy prices. There are two components to energy prices --

MR. BROOKMAN: Paul, please, go ahead.

MR. SOHLER: Paul Sohler.

Before we move on, maybe I missed it, but in the incremental installation costs you're going kind beyond the -- you have basic costs for things like plumbing that apply to all classes of equipment. In the case of condensing boilers, did you allow anything additional for secondary -- you know a lot, maybe not all, but I would say most you know manufacturers require a primary/secondary pumping, so you've got changes to the new boiler, piping around the boiler that you would not have with a non-condensing boiler in a lot of cases.

MR. FRANCO: That's very good feedback. We did not. We considered just a single pump. And we're considering actually the same type of pump as a non-condensing. So, that would really be feedback if we can get -- and especially if we can get fractions where it would be applicable. We do understand that there are a lot of systems that -- for example, zone systems that would require potentially separate pumps, maybe even valves and to understand what's the differences between non-condensing and condensing would be really valuable to us.

MR. SOHLER: There are, I would say, almost always even on a single-zoned system two pumps on a condensing boiler and the one that pumps through the boiler is often considerably larger than the one that you might use to circulate water through the system, which, by the way, is going to drive up the energy -- the electrical consumption. So, that should be taken into account.

MR. FRANCO: Great. No, that's great feedback. Thank you so much.

MR. SOHLER: Thanks.

MR. BROOKMAN: Thanks Paul. Yes, please, Alex.

MR. LEKOV: Alex Lekov, LBNL.

So, just about this secondary pump is it part of the boiler design or this is something that is installed additionally in the field?

MR. SOHLER: In some cases the manufacturer supplies a pump with the boiler that's designed to provide adequate flow through the heat exchanger and then the installer supplies the second pump. In some cases the manufacturer supplies no pump, but the installer is directed to provide two pumps. And there may be some cases -- I don't know this for sure -- where the manufacturer supplies both. I would say that's probably the minority. Again, some inspection of installation manuals would tell you, you know, but it's basically a matter of getting adequate flow through the heat exchanger, which typically has a higher pressure drop than that through a conventional boiler regardless of what the flow is out in the system.

MR. BROOKMAN: Okay. Thanks.

(Slide.)

MR. FRANCO: Thank you for all those comments.

So, next, we will be talking about energy prices. And again, energy prices there are two components to them. First, the energy prices related to the household and the year that we were considering 2012 and that we would be escalating those based on energy price trends in the next slide. We'll be discussing that.

So, we developed average marginal monthly prices for each household and building. The marginal prices are significantly different than the average prices for natural gas and electricity. There are no marginal prices assumed to be different between average and marginal between LPG and oil monthly prices.

The methodology is to come up with, first, regional average annual prices by month, and then multiply those by monthly price factors and then marginal price factors. And we do take into account differences within certain buildings and regions. So, based on CBECS and REIS data, we come up household building price factors.

The data sources are primarily EIA to come up with these average annual prices, the monthly energy price factors, and the marginal price factors. Details of this are provided in the appropriate appendix in chapter 8. And the household and building energy price factors comes from the RESI and CBECS building data.

MR. BROOKMAN: Yes, John.

MR. RODER: Victor, I have to apologize. This is John Roder from Burnham Holdings.

Can I take you back because I'm really struggling with one part of this?

MR. BROOKMAN: Which page?

MR. RODER: Back to Slide 79. I've had some experience personally and professionally with re-lining chimneys. And it says here "Chimney re-lining for orphan water heater $840." Where did you get that data?

MR. FRANCO: This is re-lining, yes. So, this is based on the venting -- again, we taking a look at these household, single floor, two floors, depending on that venting and depending on -- we're assuming kind of like a flexible aluminum liner kind of situation going through. Based on the installation location and the vent length, we come up with the 840. The orphan water heater usually the vent size could be significantly smaller. Usually, it's about 2 or 3 inches because the input capacity of the water heater is --

MR. RODER: Right. We have pretty much determined that the boiler installed base is intercity row homes typically more than one or two stories. I mean so I think that needs to be factored in. All right, but let's take that piece of data and go back over to slide 84. If you look at the -- we believe, and my colleague, Paul Sohler, can give you the technical reasons better than I can for this, but when you move to an 84 or an 85 percent efficiency that causes a need to line a chimney.

To line a chimney is going to be at least I think close to a thousand dollars. You're saying $846 for a water heater. Lining a chimney for a boiler vent is going to be considerably more; yet, you say that the incremental cost is $56 to go from say 82 to 84 and $180 if you go to 85. That must be that you're not accounting for the fact that at 84 and 85 you need to line chimneys.

MR. FRANCO: We do account for lining chimneys, but it's only on these orphan water heaters. You're talking about the case of stainless steel installations, I assume.

MR. RODER: As to the particular lining material I think stainless steel is one option.

MR. SOHLER: Yes, aluminum would be -- again, depending on what type of boiler we're talking about it's conceivable it could be aluminum.

MR. FRANCO: I think I understand. Maybe this might --

MR. CYMBALSKY: Can we go to Slide 78? I think that's where the chimney re-lining costs are.

MR. FRANCO: Yes. That's the water

heater. Now, in terms of chimney re-lining of a boiler, if we go back to 78 --

MR. CYMBALSKY: So, that $1600 roughly.

MR. RODER: Right. But doesn't that even prove the point more though that if it's $1600 the incremental cost between 82 and 84 would be at a minimum $1600.

MR. FRANCO: Well, that's only applied to a fraction. And in this case, if you look at the chimney re-lining and then re-sizing there's only a very small fraction, so it's only applied to 4 percent of installations, for example.

MR. STANONIK: John, I'll explain this the way I understand it; and it's probably not going to be fair to DOE, but I guess they'll have to accept that. I look at that and so they say, okay, that's the cost, but only 5.2 percent of the houses will need that. So, in essence, they're assuming that all the customers that don't need it are going to help me pay for it because I do need it. So, they basically disperse the cost of that across all households that have the installation.

MR. FRANCO: No, no, no.

MR. STANONIK: Well, then how do you go from $1600 to $40.

MR. BROOKMAN: Okay, Victor.

MR. FRANCO: Thank you. No, that's something I wanted to clarify from the beginning. So, all these values we're saying are average values are essentially what you're saying they're average values. From household-to-household, the specific costs are added. So, for example, for 5 percent of the households they will get this $1600 cost and they will get that significant cost for that household. The other household would have no cost associated to doing this.

MR. STANONIK: All right, so then when I get to the life cycle costs discussion then we see -- Frank Stanonik, HIR.

Then you see this incremental cost that says, oh, and when we're all done with this analysis the actual incremental costs for these step ups in efficiency is in the tens of dollars.

MR. FRANCO: And that's because of how

we're averaging. You also need to consider new construction, new owners and that gets all averaged in to those values. Those are average values. If you looked at the individual household, you do have some households that have this huge cost.

MR. STANONIK: I'm sorry. I was looking at 84.

MR. BROOKMAN: Okay.

MR. STANONIK: I'm sorry. My mistake. It's average installed cost.

MR. BROOKMAN: Okay.

MR. STANONIK: But I'm still looking at a very small incremental increase, and yet, we're talking about some percentage of homes that have incremental increases that are, in this case, 10 times that or more.

MR. RODER: Paul, did you want to offer a comment?

MR. BROOKMAN: Paul, please.

MR. SOHLER: See, coming back to that, we talked about this before. At the bottom of page 84, these are incremental costs. So again, you made an assumption that 100 percent of the chimneys built before 1995 you know are going to require re-lining at whatever tech level you happen to be working at is what I see here, so this incremental cost would then be above that baseline; am I not understanding that right?

MR. FRANCO: No, so it would be two criteria. One is the household was built before 1995, but also the boiler was also installed before 1995. There are a lot of households that have a new boiler between 1995 and 2020.

MR. BROOKMAN: And if a new boiler was installed after 1995, then you presume that it was re-lined appropriately at that point.

MR. FRANCO: Correct. And that's why the fraction of chimney re-lining is only about 5 percent if you go back to Slide 78, if not, it would be much higher if we assumed that it was 100 percent.

MR. BROOKMAN: And the great bulk of boilers in the installed base between 1995 and 2020, the great majority of that installed base is in place.

MR. FRANCO: Correct.

MR. CYMBALSKY: I mean it probably would be helpful to know what the average age of the boiler and the stock is in 2020. I think that would help him with the math.

MR. BROOKMAN: Really this is important. I want to get to the bottom of this if we can, so keep thinking about what your questions would be and let's drill down here.

MR. RODA: I'll dumb it down and I'll just be natural and that naturally dumbs it down. DOE says go to 85. We want to go to 85 percent. We are asserting that if you go to 85 percent you have to line the chimney every time. That's more than a 42 or $52 incremental cost differential between an 82 and an 85. And I just don't know what I'm not understanding here, but it just does not seem to be taken into account.

MR. BROOKMAN: Okay.

MR. RODER: 85 request flue line -- excuse me, chimney lining. Chimney lining costs a thousand dollars minimum. How you can come up with an incremental cost that is $56 or $180 doesn't make sense.

MR. BROOKMAN: Okay, Victor.

MR. FRANCO: Hopefully, this will explain a little bit, and I would say your feedback, and hopefully this explanation will help you also provide better feedback.

So, we're assuming that chimney re-lining is required, for example, here for 5.7 percent.

MR. RODER: Non-condensing to non-condensing.

MR. FRANCO: Non-condensing to non-condensing at 82 percent. And if you go down further, about 4.3 percent require the chimney re-lining in terms of doing the metal vent. Because a certain fraction go to stainless steel, the stainless steel cost will include the chimney venting for the remaining 1.4 percent.

In essence, you have chimney re-lining at 82 percent fraction similar to the 85, so there's no differential.

MR. RODER: Right. And you're suggesting

that they're virtually the same, 5.7 percent to 4.3. Correct?

MR. FRANCO: Because the stainless steel includes that cost in the stainless steel. It's kind of included in that -- the 1.4 percent is included in the stainless steel.

MR. RODER: And I think perhaps some of the difference may be the issue that we believe that 85 percent it's not 30 percent, it's not 4.3 percent. It's virtually all.

MR. FRANCO: And that's the type of -- yes.

MR. RODER: And Paul, I'm going to ask you to help me on the technical side.

MR. SOHLER: What you asking a minute ago? I missed it.

MR. CYMBALSKY: The question I think I hear is no matter what the situation of the house or the chimney if any of us here today have a boiler installed, no matter what efficiency level it is if I buy an 85 do I need to re-line the chimney every single purchase time.

MR. SOHLER: And we would submit, yes.

MR. CYMBALSKY: No matter what's in there right now?

MR. SOHLER: Yes.

MR. CYMBALSKY: Even if I have an 85 in there now.

MR. SOHLER: If you have an 85 percent in there now, no.

MR. CYMBALSKY: What if I have an 84? I mean do you see what I'm getting at here? I mean you're saying every single -- he's saying every single time, but the market's not all at below 80. It's not all at 82, so what we're asking from the stakeholders is to give us -- we don't have it exactly the way you think it should be we're asking for the data to tell us what it is.

MR. BROOKMAN: Amy, I believe.

MS. SHEPHARD: Yes, Amy Shephard with AHRI.

I want to just point out that in the NOPR DOE notes that Crown Boiler, U.S. Boiler, and New York Boiler didn't think that this venting issue was correct and they urged DOE to get input from building inspectors and code officials, which I think makes a lot of sense. Like let's call up and get some actual quotes and see if we can validate this data.

And DOE said that gathering input from a representative sample just wasn't possible in the timeframe of the NOPR preparation, but the NODA, the final comments on that was in February 2014. And you said earlier that it was submitted -- the NOPR was submitted to NIRA in April of 2014, which is only a period of a couple of months. And I would suggest that -- I mean this seems like a big issue and it makes sense and I think that there's some burden that needs to be placed on DOE to also use available avenues to get this data rather than just saying always well the manufacturer should give it us. That's my point on that.

MR. CYMBALSKY: So, all I'm saying is if an assertion is made is to back it up with data. That's all we're saying.

MS. SHEPHARD: Amy Shephard again.

And I think that it's been requested that

DOE also take some actions I think that are very reasonable in consulting these code officials. And what it says in the NOPR is we just didn't have time, but it was two months from the NODA in which that comment was raise to when DOE submitted the NOPR, and I think that the time could have been taken to resolve this data as well from DOE's end.

MS. MAUER: Joanna Mauer, ASPA.

Just a clarification, my understanding, Victor, is that in the analysis the assumption is if you have an unlined chimney and you're installing an 85, then you always would re-line the chimney, so I don't think there's any assumption that if you have an unlined chimney you would not re-line it to install it.

MR. FRANCO: Correct. Yes, we were referring to the 100 percent of the time that you have an unlined chimney we have to do that. The only thing is the criteria of when potentially you do have that situation and that's one of the slides, Slide 85, more or less goes into that criteria. And I think that's the only potential discussion point.

So, we are assuming that the boiler is installed before 1995 or the household is built before 1995 that you do have an unlined chimney.

MR. BROOKMAN: This is 75?

MR. FRANCO: This is 75, yes.

MR. BROOKMAN: Yes. Okay. Let everybody get there.

MR. FRANCO: And in that case when you have an unlined chimney, we do have the cost for the re-lining.

MR. BROOKMAN: Okay, any additional clarifying questions or comments here? Paul.

MR. SOHLER: Yes, this says -- or I guess what you're saying is that you'd really say a boiler was installed -- well, no. Okay, if either of these happened before 1995 -- yeah, if the boiler was installed or the building was built, so I guess really it would be that that's implying that if you had a building that was -- the chimney was built before 1995, boiler is new, that you'd have to re-line it, which is not what you're saying.

MR. CYMBALSKY: I think this is just get

at -- '95 was, I guess, the year where this code came in, right? Am I right?

MR. SOHLER: That is correct.

MR. CYMBALSKY: So, if the event is you built a new house with a boiler it had to meet that code, or the house is older than '95 and it put in a new boiler after '95 it had to meet that code as well. I think that's what that says.

MR. SOHLER: Nonetheless, there is, I think, a false assumption here that you must re-line for all these tech classes. You always, always, always put in a chimney liner and that is not what the Fuel Gas Code says.

MR. CYMBALSKY: Right. So, I think what you've been saying is that at the 82 level if we assume 100 percent re-lining we're capturing costs that you don't think is actually there.

MR. SOHLER: That's exactly right. Yes.

MR. CYMBALSKY: Okay.

MR. BROOKMAN: Thank you for clarifying that, John. Now, we're going to press on.

MR. FRANCO: Thank you for all those

comments.

MR. BROOKMAN: Rick.

MR. MURPHY: I actually have a question on the pricing.

MR. BROOKMAN: Rick.

MR. MURPHY: Rick Murphy, AGA.

So, just going back to the pricing for a minute, if I go to Slide 61 and I see the annual consumption for the various levels of efficiency ratings. For instance, gas-fired hot water boilers ranging from 84.1 to 70.6, and then I look at the life cycle cost analysis spreadsheet and look at first year operating costs I realize that there are ^^^^ part of those first year operating costs include electricity. Correct?

MR. FRANCO: That is correct, yes.

MR. MURPHY: So, if I try to back that out and then take that dollar number and divide it by the annual MMBTUs, I'm getting rates which you referred to marginal natural gas rates that are significantly higher than the analysis work that AGA and APGA did on marginal gas prices. So, I want to state that for the record. I know in the furnace proceeding we had that same point, but I want to state that our numbers are looking significantly different on the marginal pricing.

MR. BROOKMAN: And your written comments, please.

MR. MURPHY: Yes.

MR. BROOKMAN: Thank you. We have a comment from Robert Glass. Robert asks the question -- he's joining us online -- does the life cycle costs include the necessary replacement of the condensation neutralizer material (calcium silicate) when depleted based on the amount of condensate neutralized?

MR. FRANCO: Thank you for that question. That does take into account in the maintenance, which will be two slides from now, so we'll discuss that.

MR. BROOKMAN: Okay. So, we'll address that then. Okay. We're going to keep moving on.

MR. MURPHY: Just one follow up on pricing. Victor, is this going to be updated, the pricing on the newly released EISA data?

MR. FRANCO: That is correct. Thank you.

MR. BROOKMAN: Okay.

MR. FRANCO: Going back one second. So, we just finished energy prices. Let's talk about energy price trends. So, we use AEO 2013 Licensing Division to make our projections form 2020 to 2040, and the projections are available here in the data in this chart. Further details area in chapter 8.

MR. ROSENSTOCK: Steve Rosenstock, Edison Electric Institute.

And I know this is from 2013, and I'm not sure how the projections look in the 2015. I'm guessing they're different. They just came out. I didn't get a chance to look at the projections here, and I know it's tough, but you know last winter during the polar vortex propane prices went up to 4 or $5 a gallon when you could get it. Now, they're back down to I'll say the regular prices. Also, there were -- I'm just thinking as a fuel oil thing here and like if you know fuel oil prices were $4 a gallon. Now, they're about $2 a gallon, I think, from what I've seen -- some of the information that

I've seen. And prices over time for a lot -- well, electricity, I think, looks okay, but I'm just saying just for the fossil fuels, again, it's always projecting an upward trend, especially after 2020.

And when I look at history I always like to look at the history of prices of all of these and I know this is a projection, but it seems like actually the real prices for energy don't go up. They tend to flat line or they're below inflation. I know for electricity that's been true for 50 years. So, has there been any thought about doing a sensitivity analysis with flat or declining energy prices on a real basis?

MR. FRANCO: Thank you. We appreciate that question. We do have a sensitivity analysis that's based on this low economic growth and high economic grow that does have a little bit different, but we don't have any other scenarios. It would be good if you would provide any comments.

MR. ROSENSTOCK: Steve Rosenstock.

Yes, there's that one from EIH and I think it goes back to like 1967 or '62 for a lot of commodities showing, so in times of high and low economic growth the prices were pretty much flat or declining on a real basis. It was like the state of economy was irrelevant in terms of what was happening with the prices.

There's some correlation, but in a lot of cases when there's -- you know there've been times when the prices stay flat rather than increasing, so the result of this is you know any time there's an increase in projection -- and I can understand why, but you do tend to overstate the savings that will have an impact on the life cycle that this type of projection will overstate the actual savings that consumers will see.

And I've said this in other proceedings, but I think it's critical because you know you're talking about you know 1 percent increase here, l percent increase there. Well, you know this projection could have huge impact on your life cycle cost analysis.

MR. CYMBALSKY: We will forward your comment to EIA.

MR. ROSENSTOCK: This is Steve Rosenstock, EEI.

It's not a matter of whether EIA does it. It's a matter of does DOE in its analysis want to do a sensitivity analysis that would have I'll say you know a low price increase type of sensitivity that says, okay, based on past history over the last 50 years well real prices did not increase. This is another alternative. Here's another life cycle result based on flat energy prices or flat real energy prices, which is what's happened over the last 50 years.

MR. CYMBALSKY: So, we do in the MIA, a sensitivity, as Victor mentioned. We also perturbed in installation cost, which probably has a much bigger impact on the economics than does the energy costs. I mean if you'd like to tell us what you think the 2020 prices are for each of those fuels we'd be happy to take that as a comment.

MR. BROOKMAN: Okay, Victor. Go ahead.

MR. FRANCO: Thank you. So, just to point out, the Appendix 8I provides this alternative pricing for LCC and 10B for MIA in case you want to look at those projections.

MR. ROSENSTOCK: Steve Rosenstock, EEI.

Thanks. I didn't bring it with me, but do they assume flat or declining real prices?

MR. FRANCO: No, they're different.

MR. ROSENSTOCK: They're still increasing.

MR. FRANCO: They're still increasing.

MR. ROSENSTOCK: So, none flat or none declining. Okay. Thank you.

MR. FRANCO: So, next, we'll be taking a look at repair and maintenance costs.

(Slide.)

MR. FRANCO: So, the repair costs are the costs of replacing or repairing components in the boiler that have failed. DOE considered different sources for this data, primarily, 2013 RS means data, product costs from engineering analysis, and the following assumptions regarding the average lifetime and repair rates of the different components.

So, we included the two different types of repaired components. One we called "other," which includes ignition controls, gas valve, and automatic means and also repairing either the mechanical vent for mechanical vent boilers or the inducted forced draft blower. The assumptions about the lifetime come from studies connected by GOI in the late 1980s/early 1990s. And these are the average values, 12.2 in 15 years. And the repair rates assumptions that we're making in terms of how often these would be repaired. So, we're assuming that other components would be repaired 50 percent of the time between the lifetime of the appliance.

(Slide.)

MR. FRANCO: The material costs are provided here as well as the labor hours. The maintenance costs are the labor materials required to maintain the product. The costs are based on 2013 RS means; primarily, the labor costs. And the frequencies are based on REIS sales and CBESC data on whether the household owner reports the unit as repaired frequently.

In terms of how frequently that repair is conducted, we used dated from American Home Comfort

Survey. All the data is provided in the appendix for repair and maintenance.

In addition to this, for condensing designs, DOE accounted for the maintenance for the condensate withdrawal system, so to do any maintenance related to that and also, having to replace condensate neutralizers. The details are available in this appendix.

Finally, for oil furnaces, we did take into account impacts of low sulfur fuel oil regulations on the frequency of secondary heat exchanger clearing, and this is based on EIA projections about what areas would be regulated by 2020. The details are in the same appendix. We assume that 61 percent of oil-fired boilers would be impacted by this.

MR. BROOKMAN: Yes, please, Roger.

MR. MARRAN: Yes, Roger Marran from Energy Kinetics.

I believe all equipment is going to be -- all fuel supply by 2020 is going to be low sulfur or ultra low sulfur, I guess, where it is you know with the standards now, so that should be in place even by I think 2018 or something. New York's ultra low right and a bunch of other cities are low sulfur and going that way. I think New England and the Mid-Atlantic state by 2018, something to that affect.

MR. FRANCO: Thank you. We appreciate that comment. Thank you.

MR. BROOKMAN: Yes, Paul.

MR. SOHLER: Yes, Paul Sohler.

You said that the lifetimes and some of the data that's in this table came from a GRI research project from the 1990s? There were really no -- I say no. There certainly were some, but there were far fewer condensing boilers in the residential world back then, so I would question whether you know the data that's there is really validate, certainly for condensing equipment.

MR. FRANCO: Thank you. We appreciate that comment. We did look at the condensing furnace. Obviously, condensing furnaces is different equipment. It did have some data on condensing. And we assumed that because of their similar lifetimes and fractions of repairs that they could be approximated by these, but we would appreciate your feedback on that.

MR. BROOKMAN: Frank.

MR. STANONIK: Quick question, so Victor, the hundred dollars you have there as bare material that is the estimated cost of a new draft inducer motor?

MR. FRANCO: That's bare material costs, so it does not include any markups. So, if you mark that up two or three times more then that plus you know the labor that would be your repair.

(Slide.)

MR. FRANCO: So, moving onto the next slide, this just summarizes the repair costs. The repair costs here are annualized, so obviously, even though the household did have repair in the order of 3 or $400, these are annualized, so it might happen every 20 years, and here's the incremental costs and the maintenance is also annualized, and you can see the differentials there.

(Slide.)

MR. FRANCO: So, next, we move onto to lifetime. So, the next two components are critical to the life cycle cost analysis, lifetime and discount rates. So, lifetime is the age of the residential boiler when it's retired from service. We base this on national survey data from multiple years of RECS and American Housing Survey as well as shipment data, which I'll be describing in further detail in chapter 9.

The methodology was developed in this research paper. Based on this methodology, we came up with a lifetime of 25 years and a distribution that's provided in this graph. We assume that the lifetime is the same for all product classes and design options.

MR. BROOKMAN: Yes, pleas, Gary.

MR. HAINLEY: Gary Hainley, U.S. Boiler.

What did you base your assumption that all product classes have the same lifetime?

MR. FRANCO: So, we were looking at data, and obviously, there isn't sufficient data for condensing to determine, for example, if condensing or other higher efficiency equipment would have a different lifetime. There have been some studies in other countries, for example, in Europe, that have determined that they do have similar lifetimes.

We would appreciate it if there's any lifetime data that manufacturers could provide about that. This methodology uses historical data. Condensing, as we will look at the base case efficiencies distributions condensing equipment started be installed in 2000. And so, by 2009, which is pretty much what we have data from RESC. It's only nine years, so most of the condensing equipment would still be in the stock, and we don't know how that would be impacted.

MR. HAINLEY: Gary Hainley, U.S. Boiler.

I would agree with that. I think that you're making the assumption that without additional data to suggest that condensing product and non-condensing product last the same amount that you assume it's going to last 25 years; yet, we don't have a product in the United States that have been installed for 25 years. So, I think just the whole basis of that assumption is invalid.

The studies that I'm aware of that EPA used in their life cycle or lifetime analysis were from the UK. And my knowledge of UK boiler installations is they're not the same as ours in that most of the product that were installed -- and I believe BRG data suggests 65 percent of the product installed prior to the 2005 regulations in the UK were copper boilers, which are going to have a different lifetime than the traditional cast iron product that we have installed in the United States.

So, by then concluding that there's no contradictory data that suggest they won't last the same amount it's not an apples-to-apples comparison for one, and we are trying to find data that is more conclusive, but again, we don't have product that have been installed in the United States long enough to be able to absolutely say that they will or won't last as long. Thank you.

MR. SOHLER: And the only thing I would add to that is I think, one, and it's far from perfect, but it's sort of semi-objective source of information on that is simply to go look at manufacturers' warranties. That tells you, at least to a certain extent, what they think the life expectancy is and there is a significant difference between non-condensing and condensing if you look at that, certainly between cast iron non-condensing and condensing.

Antidotal, a lot of the Europeans that we've spoken to talk about a 15-year life expectancy, and I think that's kind of consistent with the warranty information that's out there. I'm pretty sure that we have already provided that comment to DOE. I know we did to EPA. We will again if necessary.

MR. BROOKMAN: Thank you.

MR. FRANCO: We'd appreciate all that feedback in writing. Just to point out that we do have a sensitivity analysis in Appendix 8F. It does still assume that all the lifetimes are the same within the efficiency levels, but it goes give you a sense of the impact, for example, if we assume that the lifetime is 20 years versus 30 years, for example. So, you could take a look at that. It's again in Appendix 8F.

(Slide.)

MR. FRANCO: The next slide move on to discount rates. So, in terms of discount rates, these are used to determine the present life of lifetime operating costs. We have a different methodology for determining residential and commercial.

The main sources for residential are based on the Federal Reserve Board's Survey of Consumer Finances we used from 1995 to 2010. They provide their data every three years. And for commercial, we used a Damodaran online, which provides capital asset -- cost of capital information.

MR. BROOKMAN: Yes, Steve.

MR. ROSENSTOCK: Steve Rosenstock, Edison Electric Institute.

Just a quick question about the residential, the Residential Income Group 1, is that the lowest income and Group 6 is the highest income?

MR. FRANCO: Yes. And I can describe in

more detail.

MR. ROSENSTOCK: Well, I guess, again, looking at this, looking at the table, and I don't know how detailed it was in the technical support document. I guess it seems a little counter-intuitive that the discount rate for Income Group 1 would be lower than Income Group 2 and about the same as Income Group 3. That just seems counter-intuitive to me since they're in the lowest income group.

MR. FRANCO: Thank you. We appreciate that comment. Based on this methodology, we made it consistent throughout and we will take a look at that in more detail.

MR. ROSENSTOCK: Steve Rosenstock, Edison Electric Institute.

Again, I appreciate it and I know you don't have the survey, but again, it's a matter -- I guess it spills over into your consumer subgroup analysis where -- you know you have a rising and rising discount rate and then it goes back down. Again, it could have an impact on that subgroup analysis. And again, I'm just kind of curious how -- I'm just really kind of -- it's very interesting how and why did that happen? I'm really kind of curious, if someone could explain that to me.

MR. FRANCO: Thank you. And I can go into more details. So, the way discount rates are handled in terms of residentials is that we take into account different depths and equity types the household has in its possession.

For Income Group 1, usually, they don't have too many debts or equity. They might primarily have a savings account, checking account and those would be the basis for -- main basis for the discount rate. They may have some loans, but they don't have a large fraction.

If we come to Group 2, it seems like they have more shares of different assets or debt types, and that accounts for a little bit higher discount rate.

MR. ROSENSTOCK: Yes, Steve Rosenstock, EEI.

I'd really like to see that because it's usually the lower income groups that are paying the highest interest rates for any sort of credit, whether it's a payday loan or a credit card or any sort of bank loan and you know any dollar that's spent you know is much more valuable because they have so little of it. Again, it just seems counter-intuitive to me. I don't have any statistical data. I just -- you know especially in urban areas that's where all they payday loans are and that's where all the high interest type of entities are that are there and so I would assume, based on some of that, that their discount rates would be much higher.

MR. BROOKMAN: So, anybody that's got any data that contradicts the Feds survey it would be great to have that.

MR. FRANCO: And just to clarify, we'll go into more detail on low income in a few more slides.

MR. BROOKMAN: Keep going, Victor.

(Slide.)

MR. FRANCO: So, the average overall discount rate is 4.5 for this analysis. Moving on to base case efficiency distributions, we have a few slides for base case efficiency distribution, so I'll try to go over it fairly quickly.

(Slide.)

MR. FRANCO: So, the base case efficiencies reflect the projected market share of products of different efficiencies levels in the base case, in other words, in the absence of standards. So, this reflects that not all consumers purchases parts at the current minimum standards. Consumers who are already purchases products at higher efficiencies are not impacted by the standard.

The methodology used is we tried to use as much of historical shipment data that we had, and also the boiler certification directories. The development of the historical distribution of efficiency levels in 2013 includes AHRI and Energy Star shipments data from 2003 to 2012, estimated historical shipments that will be described in more detail in chapter 9, and a combination of different certifications directories more details are available in Appendix 7D.

We assumed that the new Energy Star performance criteria, which is 90 percent for gas-fired boilers and 87 percent for oil-fired boilers will have an impact by 2020. And based on that, we're assuming that in 2013, 32 percent is the current market share for condensing and will rise to 46 percent by 2020, and similar 4 percent to 8 percent for hot water oil boilers. For gas-fired hot water boilers, we accounted for regional differences, and we'll go over those in a couple of slides.

The last point is in terms of the standby and off mode standards. We assumed that 50 percent of the market is at the baseline and 50 percent is at the max tech or above. So, let's go briefly through these, kind of summarizing the historical data and our projections.

(Slide.)

MR. FRANCO: This is the chart showing the historical and projected --

MS. SHEPHARD: Can I just stop because I had a question about something you just said. This is Amy Shephard from AHRI.

So, for the standby mode standard you said you assumed that 50 percent were AL zero and that was the baseline that you talked about earlier?

MR. FRANCO: That's correct.

MS. SHEPHARD: So, are there actual models that are at that baseline because the way I understood the way you described that was before is you took the least efficient of all those different mechanisms and you sort of created a model that had all of those. So, we're assuming -- so, is that correct?

MR. FRANCO: That is correct. Yes, basically the 50 percent is accounting for -- all these condensing have controls.

MS. SHEPHARD: Right. But you're assuming at 50 percent are at that baseline that you created, so I'm asking are there any actual models in the market that are at that baseline?

MR. FRANCO: We don't actually have the measurements, so we don't know what -- this is just an assumption and we appreciate feedback on whether this is too high --

MS. SHEPHARD: Okay. And so -- and I guess along those lines, normally, when you're doing like just a regular efficiency standard level and you start with your baseline you either start with what the current standard is or you look at what's the average in the market. So, why for the standby -- for these standards did you not kind of look at the market and think, okay, what's the most widely used baseline for these in the market as opposed to creating one that had the worst case scenario in every single factor?

MR. FRANCO: So, DOE's approach for the standby and off mode it doesn't want to take out certain technologies that might be beneficial. So, for example, the display might be beneficial for the consumer, and so it's starts with assuming that it has a display. It has a certain high wattage and then it goes down from there.

(Slide.)

MR. FRANCO: So, going to the next slide, this shows the projections. So, here we have the historical data in blue for hot water and gas boilers and in green for oil boilers, hot water oil boilers and our projections.

MR. ROSENSTOCK: Steve Rosenstock, Edison Electric Institute.

But these projections were based on the energy price trends that you were using in Slide 86, correct, or what are these? Were these based on kind of more of an extrapolation of what's been going on?

MR. FRANCO: Exactly. Yes, this is just an extrapolation. It's not based on energy prices.

MR. ROSENSTOCK: Steve Rosenstock, EEI.

Again, this is where I'd also -- a sensitivity analysis might be bad too because remember with the very low prices that also might hurt their market share in the absence of standards because you know especially if the price of fuel oil has gone down by 50 percent and natural gas has gone down by 30 percent, et cetera, then you know these -- you show these rises through 2020 and you know -- again, it could be that it's just because there's you know less savings by going to these products then the market share might not be as high just because prices have collapsed.

Again, if you're allowed to do some sensitivity analysis based on lower prices, it would have an impact here as well. Thank you.

MR. FRANCO: Thank you for that comment.

(Slide.)

MR. FRANCO: So, moving on to the next base case efficiency distributions from 2013 to 2020. So, this is a mixture of the fraction of models or fraction of shipments that are at non-condensing versus condensing and the disaggregation using the certification directories. So, if you look at 2013, this is what we come up with in terms of the disaggregated market share for all these product classes. And in 2020, based on the increasing condensing market share, we come up with these updated results. For steam, oil, and gas-fired boilers there are no changes because there's no change in the condensing fractions.

MR. BROOKMAN: We have a comment from Mike McDonald, who is online. He asks the question is the growth in condensing based on any tax incentives above the current tax credits?

MR. FRANCO: Thank you for that question. No, it isn't. It's mainly based on kind of the Energy Star increased market share over time. It also takes into account once you have a condensing boiler you will be more likely to replace with a condensing boiler. It's really hard to go back to non-condensing once you've gone to condensing. So, this does take into account increasing market share over time of condensing even in the replacement market.

MR. BROOKMAN: Okay. Good.

(Slide.)

MR. FRANCO: So, the next slide provides the disaggregated condensing market share by Census Division. This data was provided by AHRI. From 2008 to 2012, we have shipments data, and these are the fractions. So, you can see it does vary by regions, so we did want to use this data because it does very significantly.

Once we apply our projections, you can see that for some regions it goes up to almost 100 percent, so it would good to take a look at these carefully and see if you agree.

MR. STANONIK: Frank Stanonik, AHRI.

Just one caution for everybody, this is percentage of boilers that are shipped into that region, not necessarily percentage of all boiler sales in the nation.

MR. BROOKMAN: It's nice to have shipments data.

MR. FRANCO: Thank you, Frank, for that clarification. The other clarification is this is just AHRI manufacturers or only HRI manufacturers.

(Slide.)

MR. FRANCO: So, this finalizes life cycle and payback analysis inputs. Now, we go into the results. So, these are average values that are provided here in terms of the full install cost, lifetime operating costs, average LCC, and the average LCC savings and the median payback period. This is just for gas hot water boilers. For all other product classes, the TSC has the appropriate tables.

(Slide.)

MR. FRANCO: So, moving on to the consumer subgroup analysis. So, DOE evaluates the impact on consumers who might be disproportionately affected by this national standard. DOE evaluated subgroup analysis for low income and senior-only houses. The results comparisons are provided here for all products.

In terms of low income, it is important to note that the DOE's analysis all household pay for the full cost of more efficient boilers and fully benefit from the lower energy bills; however, most low-income households are tenants who benefit from the lower energy bills, but not have a rent increase, which cover for the higher equipment costs. Overall, tenants are probably better off than suggested by the LCC results.

MR. BROOKMAN: Steve Rosenstock.

MR. ROSENSTOCK: Steve Rosenstock, EEI.

This was discussed in the furnace rulemaking. I know this based on a study out of Berkeley, but I think -- they're not here, but the homebuilders had a different perspective on it. And I believe there's Multi-family Housing Council and you know some of their perspectives. To assume that the rent increases aren't going to cover the equipment costs, but assume that all landlords that whenever they're facing an increase in some sort of cost that they can never pass on those increased costs to tenants and there are many parts of the country -- if you look were the rents are increasing much faster than inflation, so somehow maybe not in the first year or the second year, but overall they are going to recover their costs or else they wouldn't be in business, or they might ^^^^ if they can't recover their costs, they might reduce maintenance or other sorts of operating costs in another way that would let the property degrade a little bit and actually increase energy costs.

So, I understand the philosophy behind this, but I think there needs to be some checks with the actual building owners and landlords or you know and/or home builders to see how they treat or how they recover their costs because they are going --

they have to recover their costs somehow at some point. It might not be in the first year. It might be in the second year. It might just be with the new tenants, but somehow they have to recover their costs or else they're not going to be able to run the building.

MR. FRANCO: Thank you for that.

(Slide.)

MR. FRANCO: The last slide is a request for comment. I will go really briefly through some of these. We request comment on the reasonableness of our consumer prices and also any alternative for the suggestion of using the constant trend, and if there's any data for trends of projections of prices for condensing and non-condensing boilers and any comments on the approach and data sources used for changes in installation costs for more efficient residential boilers. Also, comments that relate to installation costs of the fraction of different material types for condensing, including PVC and CPVC.

We've already gone through this, but the fraction of boilers that would be required to be installed with stainless steel venting by efficiency level. And I'll go to the next few.

(Slide.)

MR. FRANCO: We request any feedback on the sources and data used for maintenance and repair, also on its approach for determining lifetime and estimating discount rates for both residential and commercial consumers. DOE also requests comments on its projections for higher efficiency condensing boilers in 2020 in the absence of amended efficiency standards. DOE request comment on the fraction of boilers at each standby and off mode efficiency level.

Finally, any comments related to any aspects of the life cycle and payback period analysis.

MR. BROOKMAN: You see the request for comment. Please take a peek there and see if there's anything additional this time, and noting that your written remarks will be very helpful to the Department. Yes, Rick.

MR. MURPHY: Doug, I'm assuming that the issue that I raised earlier about marginal prices is covered under 4-20, even though it's not itemized out in the previous ones.

MR. BROOKMAN: You'll have to refresh my memory on the details, Rick.

MR. CYMBALSKY: It's the marginal price on natural gas. Yes, we'll take comment on that.

MR. BROOKMAN: Thank you. Let's take a break. When we resume, we will be picking up with shipments. Let's see if we can make it more like 10 than 20 minutes, okay. It's now 10 minutes after 3:00. Let's try and pick back up here about 20 minutes after.

(Whereupon, a short recess was taken at 3:10 p.m.)

MR. BROOKMAN: Thanks to all of you for being back here in 10 minutes. That was great. Good work. We're going to start with the shipment analysis, and we're going to pick up the pace here a tad to make sure we get through all this content. And we really have done a lot already. There's more to go, so we're going to jump right on it. Victor.

MR. FRANCO: Welcome back. So, we're going to start on the shipment analysis, and this is Slide 101.

(Slide.)

MR. FRANCO: so, the purpose of shipment analysis is to come up with the shipment between the analysis period, 2020 to 2049. This is a major input to the National Energy Savings MPV as well as the manufacturer impact analysis, but it also has a major impact on other inputs like we described lifetime, for example and the base case efficiency distributions.

So, the shipment projections are divided by market segment, new construction, new owners and replacements. Again, new owners include existing buildings that acquired a boiler for the first time, and also includes switching between the different product classes, and we'll describe that in a little bit detail next slides.

This analysis also includes the impact of standards in terms of consumers purchasing --

repairing rather than replacing their residential boiler. The analysis assumes the price elasticity value and assumes that the consumer is influenced by the purchase price and operating costs.

(Slide.)

MR. FRANCO: The next slide provides an overview of the shipments model. So, the new construction the two major inputs are new housing starts and the average boiler saturation in the new construction market. New owners is based on the difference between the historical shipments that we derived and the model shipment data.

Finally, replacements are a combination of annual shipments and the retirement function, which is based on the lifetime distribution that we described earlier in chapter 8.

The replacement market also takes into account shipments that are switching to new owners in another product class and demolition, so building that are no longer in the house stock.

(Slide.)

MR. FRANCO: The data sources for these

inputs are available on this slide. We use Census data and AOE 2013 historical data for housing and commercial building square footage. New construction saturations come from CBECS and RESC data as well as new housing characteristics from Census data.

Shipments to new owners are estimated based on 2008 to 2012 historical shipments compared to the shipments model estimate. The new owners are derived is the difference between historical shipments and the model of new construction replacement shipments. Most new owners are assumed to switch between product classes. For hot water gas boilers DOE assumed that the fraction are new owners that are installing a new boiler in an existing building did not have a boiler previously. That fraction is 20 percent, and that's the fraction that's being used in the LCC analysis.

The historical shipments we'll talk in more detail, but we have taken into account appliance magazine shipments from 1962 to 2008. We have been getting AHRI shipments from 1970 to 2012. Recently, we got a submittal from 2003 to 2012 shipments, and we make several adjustments that we will go into further detail in the next couple of slides. The retirement function, as we described the lifetime, is based on a 25-year average.

Finally, we calculate the fraction of commercial ^^^^ shipments to commercial applications. We already described this at 7 percent based on RECS and CBECS.

MR. BROOKMAN: Amy.

MS. SHEPHARD: Amy Shephard, AHRI.

And what price elasticity did you use and what was the source of that?

MR. FRANCO: The price elasticity is further described in Appendix 9A. It's based on clothes washer and refrigerator data up to 2012, I believe -- 1990 to 2002. I believe the price elasticity value is 3.4. All the details are provided in that appendix.

MS. SHEPHARD: Okay.

(Slide.)

MR. FRANCO: So, the next slide provides an overview of the historical shipment. So, we just wanted to provide kind of how we came up with our shipments model. So now, all shipments that were provided by AHRI have all the data historical disaggregated by different boiler types. So, we had to make some adjustments in order drive our historical shipments.

First of all, the historical shipments primarily consist of cast iron and steel from Appliance Magazine and past AHRI submittals. They did not include coil and tube type and high efficiency condensing, except for the recent submittal that AHRI provided, so for past data we had to make some adjustments to take that into account.

In terms of high efficiency, we also took into account Energy Star data since Energy Star includes a little bit more manufacturers than AHRI for the high condensing fraction. There are a number of non-AHRI manufacturers, and we have an adjustment for that.

Let me go into more details about -- I won't go too much into this, but all the details are here and they are also provided in chapter 9 in

Appendix 9B. Basically, we used the cast iron shipments. We come up with a fraction for years that we don't have this aggregated data. We come up with fractions for years that are in between to come up with cast iron shipments.

For other boiler type shipments, we have a combination of sources. For steel boiler shipments we do have some shipments data. For hot water gas boilers, we based it on 1993 AHRI shipment data, and it only accounted for 0.1 percent and that's what we assumed for all years. For steel hot water, all boilers we do have different estimates and we do an estimate between 2010/2012 based on the linear trend AHRI provided.

For coil-tube type shipments, we estimated for historical shipments 7.2 percent fraction before 2012, and AHRI provided data between 2003 and 2012. For high efficiency condensing boilers we used the data provided AHRI as well as some assumptions about historical data for oil boilers. AHRI only provided condensing for gas boilers number of shipments.

Finally, if you notice the equation above has a multiple factor for adjustment for non-AHRI shipments. So, based on the 2013 directory that accounts for non-AHRI manufacturer models, we came up with an estimate of 13.3 percent of hot water gas boiler models are non-AHRI. We used this to estimate manufacturers' shipments. We decrease this fraction going backwards in time. So, we assume in 1980 that fraction is zero percent. We'd appreciate any comments on those. And for hot water oil boilers the fraction is larger, it's 26.5 percent of shipments are non-AHRI.

(Slide.)

MR. FRANCO: And the next slide provides the overall historical and projected shipments. So, take a look at this and comment.

MR. STANONIK: Frank Stanonik, AHRI.

Just as a question, did you reach out to those non-AHRI manufacturers to provide shipment information?

MR. FRANCO: No, we did not.

(Slide.)

MR. FRANCO: So, the next slide shows the shipment analysis based on the trial standard levels. We'll discuss the trial standard levels in a few slides from now, but this is based on the different levels for all gas hot water boilers.

As you can see, the difference between the base case, which is the blue line which kind of is at the bottom row of this and the TSL5, which is the max tech at the beginning there's about a 5 to 7 percent decrease in shipments. That's to account for the price elasticity repair versus replace.

MR. ROSENSTOCK: Question. Steve Rosenstock, EEI.

So, even at max tech, you're showing no difference in shipments after 2026? And you're actually showing a possible increase in shipments compared to the base case at max tech? That's what the graphic kind of looks like.

MR. FRANCO: That is correct. You do see a decrease up to about five or six years into the standard. Those units will eventually need to be replaced, so those units are then replaced during a couple-year period and then after that it's very close. The shipments are very close. The assumption is that the price elasticity kind of decreases over time. The details are available in the appendix.

MR. BROOKMAN: Victor, I'm confused by the graphic. It looks as though, as of about 2030, all you have -- all that I can see really -- maybe my eyes are not working properly -- is TSO1 combined with TSO. What's going on there?

MR. CYMBALSKY: They're all the same.

MR. FRANCO: They're basically the same.

MR. BROOKMAN: Okay.

MR. FRANCO: Yes.

MR. BROOKMAN: Okay.

MS. SHEPHARD: This is Amy Shephard from AHRI.

I have a question about what you just said. You said that it assumes that the price elasticity decreases over time?

MR. FRANCO: Yes.

MS. SHEPHARD: But you said that the --

MR. FRANCO: The impact of the price elasticity ^^^^ sorry -- the impact of the price elasticity.

MS. SHEPHARD: Okay.

(Slide.)

MR. FRANCO: This is just to request comment on the shipments analysis.

MR. BROOKMAN: Frank Stanonik.

MR. STANONIK: This price elasticity question, okay, you indicated right now you're using information that comes from refrigerators and clothes dryers, I think?

MR. FRANCO: And clothes washers.

MR. STANONIK: And clothes washers, okay. And while I'm going to make the comment, and I don't really know that we have the means to develop other data, but I think it needs to be recognized that you're dealing with products that to some extent are bought either on their physical appeal or some desired features. You know whether it's through the door ice and whatever else, okay, and that is going to affect the price elasticity. Okay.

On a boiler you know most people certainly don't care very much what the boiler looks like, although maybe the like certain colors, but otherwise you know the only other thing they may be interested in is the efficiency. And so I think you know there's certainly a very -- you don't have this consumer desire aspect when it comes to you know a boiler. You know I want a refrigerator that does this, or I want a washer that does this. They just want a boiler. And so again, I'm not sure if we can figure out how to give you a better number, but I think you need to keep in mind that really you know it's not a good fit.

MR. FRANCO: Thank you. We appreciate that comment. And actually, if you look at the request for comment, we are requesting comments and any data or feedback would be really appreciated.

MR. BROOKMAN: Steve.

MR. ROSENSTOCK: Steve Rosenstock, EEI.

Again, I'm looking back at Slide 84. You don't have to go back. Just for the gas-fired hot water boiler, the consumer price in 2013 in dollars for the baseline is $2103 and for the max tech it's $3923, so that's like you know an 80 percent price increase. And you're saying that shipments will only drop about 5 percent when this happens with that kind of price increase?

MR. FRANCO: So, this takes into the operating cost savings and the incremental costs. And obviously, it's based on this -- as Frank just pointed out -- on this data that it's based on other products. It might be different for heating equipment.

MR. ROSENSTOCK: Well, one thing that could be an analogy is you know -- well, the data won't be in, but you know now with residential water heaters if it's above 55 gallons you have to buy a heat pump water heater, which is double the price of a resistance water heater. I'd be shocked if shipments went down by only 5 percent. Again, it just seems counter-intuitive to me with that kind of a price shock that there'd only be a 5 percent change in shipments, so I'm very surprised.

MR. BROOKMAN: Okay. Amy.

MS. SHEPHARD: It's a clarification on just what you said where you said the impacted price of elasticity decreases over time. Can you explain that? What would make it -- what would cause it to change its impact over time?

MR. FRANCO: Could you repeat that?

MS. SHEPHARD: So, your question where you said it's the impact of price elasticity that's decreasing over time what do you mean by that?

MR. FRANCO: The impacts, so instead of impacting a certain fraction -- so the price elasticity assumes that there's a certain fraction of installations that would be during this repair versus replace. Over time that impact decreases.

MS. SHEPHARD: Why?

MR. FRANCO: Over time, people will be installing this equipment. There'd be less pressure to purchase like over six or more years.

MS. SHEPHARD: Well, I'm still not getting that because price elasticity is measuring your sensitivity to price changes, right, so what's causing their sensitivity to price changes to decrease over time? You're saying they'll take a larger price increase for less you know reduction in demand over time. So, what's changing the nature of that?

MR. FRANCO: Well, you do have energy price trends is one factor that's increasing over time, so that would decrease the fraction.

MR. BROOKMAN: You can see the request for comment boxes. Take a peek, see if there's anything additional before we move on here. Anything additional before we move on to NIA?

MR. ROSENSTOCK: Steve Rosenstock, EEI.

For 5.3, don't you think at max tech that the higher -- a significantly higher percentage of consumers would choose to repair?

MR. FRANCO: You mentioned something?

MR. ROSENSTOCK: At max tech. If you went to max tech, do you think that the percentage of consumers that would want to repair would go up significantly and that would have an impact on shipments?

MR. FRANCO: This is based on -- this methodology the numbers, yes.

MR. BROOKMAN: Okay, we're moving on to

initial impact analysis.

MR. CYMBALSKY: Okay, I'm going to do my civic duty and Victor a little bit of a break. I think he's earned his pay today. And looking at the clock, I think we need to kind of go through this much more quickly. This is basically getting to the end of what we do here.

So, the national energy savings is basically is what we want to get out of this. You've seen all the analyses, so now we bundle up the efficiency levels and the TSLs and we propose it and then we just crunch all the numbers to roll up what you've seen on the macro level to the national level, so that's basically what the MIA does.

(Slide.)

MR. CYMBALSKY: You could see on the next slide we've taken all the different analyses that Victor's described and Catherine and Adam have described earlier, we throw them throw the spreadsheets and we create a net present value of all the costs and savings that accrue or maybe not accrue to the consumer and get the net present value, which was discounted according to the OMB guidelines.

(Slide.)

MR. CYMBALSKY: So, on the next slide here, you can see all the different data inputs that go into the NIA. I won't read through all of these, but you've heard about all of them earlier today.

So, what's important to create the impacts is how the efficiency distribution changes once we put the standard into place. Basically, you look at the market before and after standards. You do a bunch of arithmetic, multiply numbers together, and over 30 years of shipments we come up with the NIA. So, here you could see what the condensing market share does in each of the cases.

So, then area graph here shows it by EL. So, it's pretty intuitive you know if we pick the higher EL with market share changes. And if you want the actual percentages of each this slide will through each product class and give you those numbers.

MR. BROOKMAN: Frank Stanonik.

MR. STANONIK: Sorry, but well I certainly fall into the habit too often of kind of treating oil secondary, but the slide you had on 107 do you or could you prepare a similar slide of projected shipments for oil hot water boilers at each level because it's a hugely different situation when you get to condensing oil-fired boiler and I think you know it's not going to look like this at all I don't think, just a request.

MR. CYMBALSKY: Okay.

MR. FRANCO: This is Victor Franco.

The one you're looking at what you're looking for is figure 9.5.5 in chapter nine.

MR. STANONIK: Thanks.

(Slide.)

MR. CYMBALSKY: Okay, so let's get down to the real business at hand, AFUE level. So, Slide 117 we're back on that slide. You could see the Department has proposed TSL3 for AFUE levels, so 85, 82, 86, 86. And we've heard your comments today about your concerns. You know we focused a lot on the 85, so we've heard those concerns. And again, in your written comments it would be nice to expand upon what you've said here today. Also, any data you want to provide through the NDAs that would be very much appreciated as well.

(Slide.)

MR. CYMBALSKY: Then standby and off mode, so here's it's TSL3. You know Amy was talking about you know we bundled a bunch of the worse case scenarios together to get a number, so here you could see that the reduction from that number in terms of the watts isn't very big. So, you'll get an allowance of say 9 watts on TSL3.

Then the next series of slides are just going to show a bunch of numbers about energy savings, MPVs for the AFUE and the standby mode. I am not going to go through these at all, in detail. You could read them at your leisure. The basic conclusion here is that the proposal itself is technologically feasible and economically justified with our analysis. And so, again, we're happy to take comment on all aspects of what we've done here.

MR. BROOKMAN: Yes, John.

MR. RODA: John Roda of Burnham Holdings.

Just real quick, John, on page 17 to 25 of the NOPR it talks about in the national impact section that you know a significant amount of energy will be saved and that's significant amount of energy is further defined as six-tenths of 1 percent. Now, how do you reconcile that, which seems almost like statistically insignificant, with what you're trying to show us here?

MR. CYMBALSKY: This goes back, I think, to the P-Tax rule, right?

MR. RODA: To the what?

MR. CYMBALSKY: A rule we did on P-Tax and I think a subject of a lawsuit. My lawyer is looking at me funny, but it's before my time.

MR. STAS: I think somewhere mentioned in the NOPR there should be a citation of a court case. I think it was Harrington case. And the courts helped us define what a significant amount of energy is and it says any amount that's not genuinely trivial. So, we grapple with that, but here you can see instead of looking at it in terms of a percentage, which sounds very, very small, look on the charts here on say page 119, 120 you're seeing almost two-tenths of a quad of energy, so that's an absolute value, which is a good chunk of energy to be savings. So, I wouldn't necessarily focus strictly on percentages.

MR. ROSENSTOCK: Steve Rosenstock, EEI.

That's a cumulative value over 30 years. Correct?

MR. CYMBALSKY: That's correct.

MR. STAS: Yes.

MR. ROSENSTOCK: Thank you.

MR. CYMBALSKY: Including the full field cycle savings.

(Slide.)

MR. CYMBALSKY: Okay, again, a couple of requests for comments here. And basically, we ask for comment on any and all aspects of the analysis at this point.

(Slide.)

MR. CYMBALSKY: Okay, the next slide is the RIA, so the Regulatory Impact Analysis. So, an Executive Order instructs DOE to look at other means besides setting a standard that could be used in lieu of a standard or minimum standards as a means to save energy and could it save equal or more energy relative to the standards.

So, we looked at six different things here. And looking at these, we found that none of these options provided the greater or equal amount of energy savings. So, you could see more of that in chapter 17 of the TSD.

Okay, so I know I went through that quick, but it's really mostly just a lot of numbers to look at. What's more important you got a real detailed look at how we got to these numbers. And so, at this point we're going to talk about the manufacturer impact analysis, and we're going to pass it over to Andrew.

MR. ALLEN: Thanks John. My name is Andrew Allen. I work with Navigant, and I will try to quickly take us through the manufacturer impact analysis slides.

(Slide.)

MR. ALLEN: So, the primary purpose of the

MIA is to assess the impacts of amended standards on residential boiler manufacturers, but we also try to identify and estimate the impacts of amended standards on any subgroups of manufacturers that may be disproportionately impacted by standards, such as small business. And we also try to examine the impact of amended standards on direct employment, manufacturer capacity, and the cumulative regulatory burden faced by the industry.

And the primary tool used in the MIA is the government regulatory impact model or GRIM, which is a cash flow model that helps us quantitatively assess amended standards potential impacts on the industry, and the key output of this model is industry net present value or INPV. And DOE also conducts interviews with manufacturers to refine GRIM inputs and try to better understand the industry.

So, the MIA is conducted in three phases. In Phase 1, we try to build an industry profile from publicly available information, such as Census data and SEC filings, manufacturer websites, product listing databases and we try to identify any important issues that require additional consideration throughout the analysis.

In Phase 2, we build the GRIM using publicly available data and inputs from the engineering and shipping analyses. And in Phase 3, we try to verify our key inputs to the GRIM during manufacturer interviews and evaluate any subgroups that may be disproportionately impacted.

So, during the manufacturer interviews conducted by DOE, manufacturers raised concern on four broad topics. First, the standard necessitating condensing technology could disrupt the replacement market in which most boilers are sold. Manufacturers argued this market is structured around legacy venting and distribution systems that are not designed for condensing products.

Second, a standard necessitating condensing technology can impact the vertically integrated structure of the industry, which could impact manufacturers' profitability and manufacturing jobs.

Third, manufacturers raised concern about the ability of condensing units to perform as rated in the field and meet the heat distribution requirements of their installations.

And finally, manufacturers raised concern about the durability and reliability of condensing boilers relative to lower efficiency boilers.

And DOE considered these and other issues throughout its analyses and all of these issues are related to a standard with condensing efficiency levels, which DOE is not proposing today; however, it sounds like from some of the comments we heard the legacy venting issues are still pertinent.

So, as I mentioned previously, the MIA uses an industry capsule model to quantify the impacts of amended standards on manufacturers. It's a model the industry we rely on content from several of the analyses that we've already discussed today, including the MTA, manufacturer production costs from engineering analysis, and the shipments forecast from the shipments analysis.

And to complete the model, we supplement our estimates of manufacturer markups and industry conversion costs, so for the purposes of the GRIM, DOE modeled two markup scenarios to capture a range of potential impacts on the industry. The first is the preservation of gross margins markup scenario. And in this scenario, manufacturers are able to pass through all additional costs due to compliance to their consumers.

And the second markup scenario we modeled is the preservation of operating profit scenario. And in this scenario manufacturers are not able to garner any additional operating profit from increased cost due to compliance; however, to maintain the same operating profit in the standards case as in the base case.

In the preservation of gross margin scenario represents the upper bound of INPV impacts, while the preservation of operating profits represents the lower bound of impacts.

So, for the purposes of the GRIM, DOE also models industry conversion costs. DOE estimates two types of conversions costs. Capital conversion costs being one-time investments in property equipment necessitated by standards, product conversion costs being one-time investments in research and development testing, marketing, and any other non-capitalized costs. The efficiency levels proposed in TSL DOE developed an average capital conversion and product conversion estimate per manufacturer for each product class based on market share weighted feedback from manufacturers and applied these averages to the entire industry.

And at TSL3, DOE estimated that the industry would incur approximately .9 million dollars in capital conversion costs and approximately $3.38 million in production conversion costs.

(Slide.)

MR. ALLEN: So, now that we've discussed the inputs to the MIA, here we display the INPV results of the GRIM by TSL. The results are displayed as ranges in the first two rows, and the ranges represent the results from the lower and upper bound markup scenarios. At TSL3, DOE estimates the impacts on INPV will range from a decrease of approximately 2.1 percent to an increase of .2

percent.

(Slide.)

MR. ALLEN: So, as I previously mentioned, DOE conducts separate analyses on subgroups that could be disproportionately impacted by standards. DOE identified small businesses as a potential subgroup and conducted a separate analysis.

And as part of this analysis, DOE identified 13 companies meeting the Small Business Administration's definition of a small business covered by this rulemaking, nine of which are manufacturers and four of which are private labelers.

In the table on this slide, we show DOE's estimates of conversion costs for the average, large, and small manufacturer as well conversion costs as a percentage of EBIT and revenue for the average, small, and large manufacturer over the conversion period.

DOE estimates that the average, small, and large manufacturer will experience similar conversion costs and have to convert a similar percentage of their products.

MR. BROOKMAN: Gary.

MR. HAINLEY: Gary Hainley, U.S. Boilers.

Could you explain the cutoff between large and small manufacturers? Could you define them?

MR. ALLEN: Yes. So, the SBA lays out their size standards based on NAECA's codes, so the NAECA code for boilers the cutoff is 500 employees or less. So, any entity with 500 employees or less, including all -- you know including the parent company, including any subsidiaries would qualify as a small business.

MS. SHEPHARD: This is Amy Shephard at AHRI.

And how many total manufacturers did you determine were in the market?

MR. ALLEN: Total, we believe there are 36 that sell covered products in the U.S.

MS. SHEPHARD: Okay. Thanks.

MR. ALLEN: Sure.

MR. ROSENSTOCK: Question real quick. You said there are 36. How many domestic and how many are based overseas?

MR. ALLEN: I could get that number for you. I don't have it off the top of my head, though.

MR. ROSENSTOCK: Steve Rosenstock, EEI.

Okay. And I'm just kind of curious, when you discussed with the manufacturers what is the risk of outsources as a result of the standards, different levels?

MR. ALLEN: The general feedback we got back was that you know at non-condensing levels there wasn't much just because of shipping consideration. The feedback we got back at condensing levels was you know heat exchangers could probably be sourced from overseas.

MR. ROSENSTOCK: Thank you.

MR. BROOKMAN: Yes, Paul.

MR. SOHLER: Just a comment, they are sourced, by and large, from overseas. It's not a matter of could today. That's where almost all of them in the residential world come from.

MR. BROOKMAN: Thank you.

MR. ALLEN: So, DOE also analyzed the

proposed standby and off mode standards in the GRIM and these standards were analyzed independently from the AFUE standards we discussed previously.

And the GRIM incorporated incremental additions to the manufacturer production costs resulting from the technology options for reducing electricity consumption discussed in the engineering analysis. And DOE estimates that overall impacts on INPV at the proposed TSL will be smaller than the AFUE standards.

(Slide.)

MR. ALLEN: And so, we're requesting comment on the number of small manufacturers and on the potential impacts of the amended standards on small manufacturers, also on our conversion costs estimates and the key drivers of those conversion costs, and any other aspects of the MIA.

MR. BROOKMAN: No additional comments here?

(No response.)

MR. BROOKMAN: Okay.

MR. CYMBALSKY: Okay, this is John from

DOE. I'm going to bring us down the home stretch, talk about the environmental impacts of emissions.

So, as I mentioned in the NIA, we look at the full fuel cycle emissions reductions or increases in some circumstances to the proposed standard. Full fuel cycle includes all the upstream emissions that could occur from extraction and transportation of the fuels that are used in generation, for example. We look at the marginal power plant emissions for CO2, nitrogen oxidize, sulfur dioxide, and mercury, and that comes from the AEO. We will update it with AEO 2015, as appropriate.

We look at site combustion emissions for CO2, NOX, SO2, methane, et cetera, and we use some emissions factors developed by EPA and used in their rulemaking. The FFC upstream emissions has been developed out at the lab by Katie Coughlin and there's a cite to the paper there, but basically you know what the National Academy of Science has directed DOE to do is to look at all the potential upstream emissions savings from the standards.

(Slide.)

MR. CYMBALSKY: The next slide shows the actual results here for emissions reductions or increases in the case of mercury, and then on the bottom chart you could see the estimates for the standby and off mode.

MR. ROSENSTOCK: Steve Rosenstock, Edison Electric Institute.

Just a quick comment based on these slides, for mercury is that a thousand tons or just tons? The reason I ask is when I look at AEO 2015, Table A8 that in terms of electric power sector emissions in 2013 for mercury the number was 27.94 tons. So, I mean you're saying .001 you're saying that it's going to increase by one ton or a reduction of three tons over 30 years when overall -- again, if we're going from 11 to 8 watts, when overall for the U.S. for you know like 3.8 trillion kilowatt hours it's 27.9 tons. I believe that might be off by a factor of a thousand in terms of the impacts. I'm looking at this table.

MR. CYMBALSKY: So, you're comparing one year versus 30 years of shipments, right?

MR. ROSENSTOCK: Right.

MR. CYMBALSKY: Okay.

MR. ROSENSTOCK: And also in that regard, because of the mercury rule, looking at Table 8 of the AEO, they basically by 2020 the mercury emissions are going to down from 27.94 tons per year down to 6.58 tons per year, so that about a 21 ton reduction per year, starting -- following 2016, but I'll just say 2020.

So, over that 30-year period, that's a 600 ton reduction versus you know -- well, possibly this one ton increase, which I don't believe, but again, because the EPA rules and regulations that anything showing an increase really just -- you know, again, looking at national impacts, ignoring all these other factors that are going on in the marketplace you're showing as incremental, but I never see anything in the reports, TSD, or the rules that say, well, here's what's happening nationally with emissions.

They're going down significantly and it never seems to come out in the reports. I believe that it should -- some of these things should be discussed because there is big national trends that are totally overwhelming any incremental increases estimated from these rules.

MR. CYMBALSKY: So, it is regular tons and not thousands. So, thank you for that.

So, these are reductions relative to the baseline, so I think regardless of what is going on in the baseline what we're just trying capture is relative to that declining baseline, as you say, we think we can save a little bit more, so that's what that number represents. It takes into account the trends from the AEO.

MR. ROSENSTOCK: Steve Rosenstock, EEI.

But it's an 80 percent reduction within a couple of years, so wouldn't that reduce this by 80 percent?

MR. CYMBALSKY: No, the baseline is the baseline, so we're just looking at the change from that baseline. So, if you're got two declining -- it's two lines that are declining, just one's lower than the other.

MR. ROSENSTOCK: Okay, Steve Rosenstock,

EEI.

I appreciate that the ones incrementally are different, but the overall trend is a huge reduction so that, again, it's still -- this is within the noise of the noise maybe, and so it's not going to have any -- and in my mind you're talking about -- you get to the monetization later, but in terms of national impact it's so small that it's not going to be really seen on a national basis, in my view.

MR. CYMBALSKY: Right. What we're showing is the impact from the proposed rule, and that's what it is. The baseline's doing what it is without our rule.

(Slide.)

MR. CYMBALSKY: Okay, so we just had some comments from Steve. Anyone else has comments on that up to this point; otherwise, we'll go towards the monetization.

(Slide.)

MR. CYMBALSKY: So, there was an interagency process that's been developed over the past several years in an effort to capture the monetary value of emissions, so you can see the numbers here, but you know the big one here is CO2. We just use the values that the interagency process has directed us to us, so it's basic arithmetic. We have our ton reductions and we multiply by these numbers to get the total reduction in terms of dollars. And so, on this next slide you could see the monetization of that. So, the range for CO2 is up to a billion, just over a billion in the proposed level and then, of course, much smaller for the standby and off mode.

And so that's it.

MS. SHEPHARD: This is Amy Shephard.

I actually have a comment on that. So, could you clarify exactly how the monetization of the social costs of carbon, other than the full fuel cycle is used in the statutory analysis? So, is it part of the seven factors of the economic justification or is it considered as energy savings? How was this actually used in the analysis?

MR. CYMBALSKY: So, in the NOPR you could see the tables. We show the numbers with and without the monetization.

MS. SHEPHARD: Which table are you talking about?

MR. CYMBALSKY: It's right up in the front.

MS. SHEPHARD: So, 1.6?

MR. CYMBALSKY: Yes.

MS. SHEPHARD: Okay, so I had a question about that table because it says that this is the national economic benefits, but as we know, this number is not national, it's global. And then, it has the consumer operating cost savings. It has the consumer installed cost, but it doesn't have the manufacturer costs or the decrease in the industry net present value in it.

MR. CYMBALSKY: Right. So, the consumer cost so we're reflecting the cost to the consumer, so the way the cost recovery was flowed to the consumer is how that's picked up.

MS. SHEPHARD: Right. But the table is summary of national economic benefits and costs. So, I think when you present this analysis it should have the cost to manufacturers in it. I mean they're part of the national economic benefits in costs.

MR. CYMBALSKY: Well, to the extent that they recover those costs over the analysis period I think you'd be double counting.

MR. ROSENSTOCK: Steve Rosenstock, EEI.

And again, she brings up a very good point because, as you see, in terms of the total net benefits that CO2 value at $40.5 per ton is added in as a total net benefit, including emissions reductions to monetized value. So, if you look at the monetized value at $40.5 per ton, which is kind of the -- I'll say the mid-case is kind of what they used -- it's .37 billion dollars and that's used for the 7 percent and the 3 percent overall net benefit. So, they basically -- that monetized CO2 value that consumers will never see is 50 percent of that 7 percent discount rate total net benefit.

As I recall, that because the discount rate for CO2 is locked at 3 percent that's used in both benefit totals there. Correct? For example, at

7 percent the operating costs is .64 billion dollars and then you subtract the .29 billion dollars of incremental and stolen costs. That's about .35 billion and you get a .74 by adding in the .37 from the CO2 and the .01 from the NOX and there might be some rounding in there as well.

So, based on that, the monetized value of the emissions reductions is 50 percent of the total net benefits shown at the 7 percent discount rate if I'm doing my numbers correctly. Again, there might be some rounding errors here or there because of you know the last decimal place there after the -- like before a decimal place there might be some rounding issues, but that's how it's shown in the report and that's how it's presented to the public; but that is what's being shown.

And again, one of the issues that I raised before is that in certain parts of the country, in New England under the Regional Greenhouse Gas Emissions of California, their AB32, there are market prices for CO2 for electricity that are part of the price and in the Reggie area I believe it was about

$3.50 during the last auction, as I recall. And in California, I believe the value was about $11 per ton. Those are market prices that are actually included in the electric rates that people see that will be -- that consumers will see if they reduce some of their electricity rates, and this is added on top of that when you get right down to it. Thank you.

MR. CYMBALSKY: Thank you. Well, I'm just looking at the table, and if we exclude all the emissions for the moment, the consumer operating cost savings at 7 percent is .64 and the incremental cost is .92, okay.

MS. SHEPHARD: Well, then that's the chart of consumer benefits. It's not a chart of the national economic benefits and costs.

MR. CYMBALSKY: I'm just pointing out that the rule to consumers without any emissions monetization is still a positive economic benefit, all I'm saying, but thank you for the other comments.

MR. BROOKMAN: Additional comments on the emissions and the monetization.

MR. CYMBALSKY: So, our last two analyses to discuss are the utility impact analysis and the indirect employment. So, for this one the purpose here is to look at the impacts of the installed capacity and generation on electric utilities. We used MEMS BT, which is out at the lab, and we look at the AEO forecast. We look at the change in the total generation, the primary fuel mix, and the installed capacity. And so, chapter 15 of the TSD has more information on that.

MR. ROSENSTOCK: Steve Rosenstock, Edison Electric Institute.

Again, I will ask that -- you know you're looking at an upstream analysis, but you're ignoring any sort of upstream analysis on gas or fuel oil production when that's going to be the primary impact of the rulemaking. I find that rather -- I'm sorry. To me, it's an incomplete analysis. And then when I'm looking at chapter 15 showing that there's actually going to be an increase in coal-fired power plant -- that there's going to be an increase in capacity of coal-fired power plants I just find that kind of hard to believe based on current trends and the EPA's rule that's going to be coming out in June or July because that is going to have significant impact on what's going to happen with power plant installations and existing power plants in the U.S.

I understand why you're doing this, but it's still -- it just seems to be ignoring what's happening with EPA and some of these assumptions in terms of increased, especially cold-fired power plants just don't seem realistic to me. I'm sorry.

MR. CYMBALSKY: These were based on AEO 2013, so obviously the landscape's changed since then and if and when EPA finalizes a power plant rule and that become part of the AEO forecast we will pick it up in all of our --

MR. ROSENSTOCK: Steve Rosenstock, EEI.

The only problem is AEO 2015 is out. The rule comes out in July, so the next version of AEO won't come out until either December -- the earlier version might come out until December, but the next official version of AEO won't come out until next spring. And again, the proposed rule is a 30 percent reduction in carbon based on 2012. That's going to be a huge impact on what's happening with power plants over the next several years, so I don't know how you -- this affects all rules, obviously.

Again, it may be just another sensitivity analysis, but obviously that rule is so huge and just in terms of upstream electricity that all these other projections have to be totally changed because everything is going to change come June or July when EPA comes out with that final rule.

MR. CYMBALSKY: Okay. Thank you for that comment.

MR. BROOKMAN: Rick.

MR. MURPHY: Yes, I don't believe it would be relative to this particular rule, but if there was a standard that had an impact on the pressure requirements for gas appliances that would be needed would that be included in here? The delivered pressure to the home or the business would have to be upgraded in order to serve that new appliance. Would that be part of this analysis?

MR. CYMBALSKY: So, maybe clarify what you mean. So, some other government agency comes out with a rule about a pressure requirement?

MR. MURPHY: No, no, no for an appliance, a gas appliance under a new standard if it required a certain level of pressure to the home that didn't exist today and the system had to be upgraded, the natural gas system would that be accounted for in this section here?

MR. CYMBALSKY: We'd have to think about that, I think

MR. BROOKMAN: Yes, Paul.

MR. SOHLER: As much as I would like to throw that rock at this, I can't do it. I think, by and large, you know the pressure requirements for higher efficiency equipment have not gone up. If anything, they've gone down.

MR. MURPHY: Rick Murphy, AGA.

I'm not suggesting that this rule would in this analysis. I was just curious if something like that would be considered in this part of the analysis.

MR. SOHLER: Paul, thank you for the

clarity.

MR. BROOKMAN: Thanks. Are there additional comments on utility impact analysis?

(No response.)

MR. BROOKMAN: Nothing there? Okay.

(Slide.)

MR. CYMBALSKY: Okay. And I think our last technical slide talks about indirect employment impact analysis. So, the idea here is that if consumers have extra money in their pockets due to saving monthly energy bills some of that money would flow back through the economy in the form of other purchases, and so this is the idea that the macro economy could improve just because there's more goods and services being purchased with that extra money and so, you can read about that as well in the TSD, but that's the general theory on that slide.

And so, with that, we've come to the end and so we're --

MS. SHEPHARD: Actually, I had one question on the employment. On the indirect impacts to employment in the NOPR, it says that it limits it to the year 2025 because of the uncertainties in it; yet, when you look at the social cost of carbon there's all kinds of statements about the uncertainties of that and it goes out past the year 2100. So, why is it that in some areas of DOE's analysis there are limitations on the measurements on the costs and benefits and in other areas they're so much broader?

And going back to the Tables 1.5 and 1.6, it says the same thing. It says that some of the benefits to the consumers go beyond 2049, but why? I mean if they were going to measure the benefits to them going beyond 2049, then we should also be including the repair costs and other things that are going to them.

MR. CYMBALSKY: We look at 30 years of shipments in the analysis, and so it's everything that purchased through that 30th year. I don't know about the repair -- the repair cost goes out as well. So, we stop the shipments after 30th years and everything associated with those shipments is captured in the cost, including the repair.

MS. SHEPHARD: I would suggest that that one be clarified then in the rule because it currently says only benefits are included.

MR. CYMBALSKY: Okay.

MR. BROOKMAN: Thank you. So, now we're at the point where we are eliciting any final remarks, any closing comments from members present and we'll take those now.

MR. WEISS: Yes, this is Corey Weiss with Field Controls. Thank you.

Obviously, a tremendous effort went into producing the technical support document and it's going to probably take an equal effort to have a reasonable review and response, but I wanted to take a step back from the numbers. Frankly, it got numbing there towards the end. And I want to repeat some things that I've heard today and have read and then maybe add a few new things or just a new or different perspective; but in listening to everything, for me what my take aways the boiler is part of a system. It's not like a stand-alone thing that we just say you are now 85 and be gone. It's part of a system.

You know it is covered to some extent in the NOPR in the technical support document, but I don't think it's received as much emphasis as it really should. You know 90 percent of the boiler sales are replacement. The new construction, new owners I'm having a hard time conceiving of anyone that's going to change their hot water distribution unless it's old house and they're basically tearing it down and building a new one, so you have that finite, that constraint of the hot water distribution system.

And the NOPR even indicates that you know that really negates going condensing because you're not going to see the efficiency that a condensing boiler in a brand new installation designed for that type of equipment is going to deliver, so I agree with the Department in not going to that level.

As far as the 85 versus 82, and then one of the other things I want to touch on is the directory, because that's been kind of boon and a bane throughout these rulemakings that I've participated in. 85 percent there's a reason that the industry is pushing back. They already have this equipment, so this isn't like electric vehicles or something where this mandate comes down and now energy has to somehow pull a rabbit out of their hat. They have these pieces of equipment already.

So, it's not like they don't want to sell these boilers, but when you look at the installation, these replacement installations they don't want to sell these boilers in certain installations. That doesn't mean that an 85 percent boiler is unsafe, but there's a lot of installations where it starts to get rather fuzzy and the industry doesn't want to go there. So, I'm going to play the safety card because that's really what we're talking about. And I respected the numbers, the effort, everything that went into it.

The averaging and annualizing the costs I'd like to know where I can get my boiler repaired and only pay $46 over 20 years for that repair, but that is what it is. It comes down to safety. And you know I heard comments about contractors. We've all had work done on our home. I assume you know we all have a home or an apartment, wherever we live we've had to have work done.

We've seen good contractors and we've seen bad contractors. We've heard horror stories and we've had people you know just swear that this is the greatest guy. You got have him come out and do it for you. So, I'm going to agree with the Department. I'm going to assume that all contractors are conscientious and they want to do a good just. So, why can't we trust them to make the right decision over this product offering that already exist as to what is best for the customer? You know if that customer has a short chimney and you know short run to the chimney and they can put an 85 in and it's good and they're out there, but if we now have a boiler that was sitting in the middle, going up the middle you know in a row house and now we got to somehow get to the outside wall and go through all the gyrations to do that you're increasing the odds of that turn out well.

And I think you know this is the last

thing I'll say on it is that this is the thing with the directory. It's kind of a two-edged sword. You know the marketing departments at the various manufacturers they just love to you know push stuff, come up with stuff, then the engineers or the technical people now have to live with that. And you know I'm just -- it's hard to come up with numbers. It's a sensitive subject, you know, liability, safety.

You know no one's going to come out and say you know 85 percent of the contractors are like bozos and they're putting in like death machines. No one's going to say that. And yet, at the same time there's this you know reservation about saying you know some of these things, but that's what's at the root of this reservation on the industry to just go to 85. Yes, there's 65 percent, 85 percent boilers in the directory and all. You know clearly they make them. They can sell them. There's a reason that they want to in every case.

And the problem I have with the 85 percent, and then I'm going to stand down, is right now the contractor can look at each installation, each job and make a decision based on those set of circumstances on what the best appliance is for that customer and for that -- you know the best because they want to put in the best job they can. If you're now taking away that option where now they have to put in 85 percent no matter what, they have no leeway, they got to this. Now, I guess they could go condensing, but again, you're painting yourself in a corner because the distribution system is going to undermine whatever you're trying to do for raising the efficiency.

So, I wanted to say that after listening to a lot of good comments and really a lot of work that went into this document, but I really feel that the industry is -- they're not digging in their heels. They're really showing their concern for all of us. You know certainly all of us that have a boiler and wanting to not do something that could negatively impact their customers. You know one wants to get sued, but I'll tell you what, I'm in the same as with Gary and Paul in this, and nobody wants to be associated with a product or an install that someone died. And I've been to enough death cases you know where people have died and nobody wants that.

So, I just wanted to bring that kind of back in because after many hours of numbers this is really about people and making sure that when all of us go home what we go home to is something that our families -- you know we're going to get up the next day because I've been in installs where the Christmas tree is still up and the presents are there and the people died two days before and I don't want us to lose sight of that you know as we look at these numbers and the dollars and cents of the thing.

You know, ultimately, all of us have stuff in our home that we're trusting is -- you know is safe. So, I can't say what that number should be. I defer to my industry colleagues on that, whether it should be 83, whether it shouldn't change, but my sense is is that 85 and 84 are -- you know they're cause for concern and I think that that should really be taken into account here, along with all the other you know factors that go into this decision. Thank you for your time.

MR. SOHLER: Paul Sohler, Crown Boiler.

I want to touch base real quick on one thing and then ask a question. Number one, when we went through the manufacturing impact analysis, it kind of passed us by before we got our ducks in a row to share our thoughts on that.

I think we are convinced that if the minimum gas boiler, water boiler efficiency goes to 85 that it's going to have a significant negative affect on our ability to keep our foundry running, which you know relies -- for those to be economically viable they need to be running at full capacity most of the time. So, to the extent that going to 85 -- and again, tying back into what Corey said, you know do, to a large extent, have a market that's stratified right now in the 82/83 range and then condensing.

So, to the extent that that 85 pushes people up into the condensing range it will cost American jobs and not only will it drive -- have a negative impact on the foundry, but it also is going to have the impact of driving up the costs of some of the other classes that are made out of cast iron where all those fixed costs need to be spread out over the gas steam boilers and you know oil boilers and other types. So, there's a very definite, major economic impact and it's going to I think have an impact, have a tendency to ship jobs out of the country.

And the last question I have, and I'll shut up, is that we had a discussion a little while ago about kind of going back and reworking you know this analysis, which by the way, I recognize a lot of hard work went into it. And are you saying -- you know we're going to try to you know provide some quantitative data in places where we talked about -- you know there's a lot of moving parts here.

I think it's fair to say that the benefits are very, very small. Your intention is to go back through this again and re-calculate or re-do this analysis with new data?

MR. CYMBALSKY: So, any new data we

receive as a result of comment to the NOPR in this public meeting will be taken into consideration. We already know we're going to update all the moderates for the new AEO data, so yes.

MR. SOHLER: When you say take into consideration, you're going to take the data, and assuming that it's credible you will drop it in -- you know all of it that you get?

MR. CYMBALSKY: That's our standard procedure.

MR. SOHLER: Okay. Thank you.

MR. CYMBALSKY: We went through this really quickly, but this is the slide that kind of addresses your concern about what will happen if this is our presumed occurrence, so at TLS3 you can see the market share basically takes everything from what was below it, but you could see here we didn't assume that the condensing market share would go up. So, if you don't think that -- this is stuff we would take comment on. Okay.

MR. MARRAN: Yes, Roger Marran with Energy Kinetics.

Just very briefly, I agree with DOE with respect to going to TSL3 is going to be primarily focused on increasing heat exchanger area. And in moving in that direction, there are two things, one we mentioned earlier, the max tech for atmospheric and natural draft vent puts a ceiling on those products. 86 and 85 put a floor on those products and that squeezes the range any given product can serve.

In doing that, it's pretty clear for the markets dominated by cast iron boilers and if they have to move up they're going to add a section if they have to get into that range, which adds mass. And when you add mass, you're adding to what can be correlated with the idle loss on the system, which has a dramatic impact on the actual annual efficiency, depending on what your re-gain assumption is in the home.

I know there's a lot that went into it on this as side of it as while. So, the thought, though, there is it's possible you could have an improvement in AFUE through the rule, but through actual field performance with idle loss taken into account you could reduce it by more than what you're increasing the rule by and you could actually have a backsliding effect in the industry, depending on how that plays out with really the re-gain amount in that mass.

And from a manufacturing perspective, I know Paul mentioned some things with manufacturing efficiencies on foundries. For other manufacturers that don't have foundries, it means introduction of new products because you can't serve as broad a range with a single product, so you have to introduce new products as well.

So, I think there's some impacts there that are a little different than the costs that we're looking at here too, but from the perspective, overall, from an efficiency standpoint and a manufacturing standpoint how that all come together and play out can have a profound impact on how the calculations worked to establish that.

MR. BROOKMAN: Additional thoughts? Yes, Frank Stanonik.

MR. STANONIK: I'm Frank Stanonik, AHRI.

We touched on this I think very early in this meeting, but one of the issues that -- I mean, obviously, we recognize we need to just, to the extend we can, provide some data and help better inform the analysis, and we'll try to do that; but one of the other issues that is very significant here is that we're convinced that the revised test procedure is going to change the AFUE for boilers. And so, we have this little bit of this, if you will, moving target situation that we're trying to look at the analysis to review the standard and yet what we're seeing is that when we looked at the revised -- proposed revised AFUE procedure for boilers we're going to get a different number.

And so part of this we're trying to develop some of that information to show why we're concerned and where we think that happens or you know in what parts of the procedures causes that, so that's something we're working on at the same time we're trying to deal with this analysis. And so, John you'll see I mean that's part of why we're asking for the time extension, but the only other thing that I would say thanks to some of the slides that were presented here now when I see SOB I'm going to think of steam oil boiler.

(Laughter.)

MR. BROOKMAN: Rick.

MR. MURPHY: Yes, Rick Murphy, AGA.

I want to thank DOE for allowing us to be here today. I found it very informative. The work was very comprehensive and appreciate the ability to go through t hat. I really appreciate the feedback that the manufacturers provided. It was one of the key reasons why I wanted to come and listen directly from the people who are manufacturing this product.

An important take away for at least me is the fact that -- and the gentleman at the end of the table I think articulated this earlier is that there's going to be a certain percentage of the market that this 85 percent standard will actually force it to become a condensing standard. And when you look at the LCC spreadsheets and moving into those condensing levels that's when you start to see a greater percentage of the market have more of net cost than a net benefit. So, that is of deep concern from the industry that works directly with the end users of this equipment and the customers. So, I really appreciated the dialogue and the information and the willingness for the manufacturers to share their perspective.

MR. BROOKMAN: Final comments before we move towards closure here. Gary.

MR. HAINLEY: Gary Hainley, U.S. Boilers.

Thanks again for taking our comments today. We appreciate the presentations. Not to be belabor the point, but just to confirm our support for what Frank said with the conflict associated with the test procedure and the new standard being run nearly simultaneously. We certain support an extension to the comment period.

It is our belief from initial testing that using the new procedure, as best we know it, will be a reduction of 1 to 2 percent in AFUE. So, as somebody once told me, it's hard to begin the game until you know how you're going to keep score, so I think that's my comment there.

And we spent a lot of time on gas-fired water boiler product class level, and I think everything's been supported, our concerns with venting. I don't have anything new there, but we believe a better alternative is to set a minimum efficiency level of 83 percent, which would allow most existing chimneys to stay in effect.

It gives homeowners choices. It allows them to decide if they can afford to go to a higher level they will. They do it today. People are buying condensing boilers today and it's not regulated. They're doing it because they can afford it and it's economically justified for them, not because they're being forced to do it. I think the same thing applies here, that in some cases 85 is just not appropriate. We like to continue to give our customers choices and we do think that it is a safer and broader product offering.

The last comment that I have is on the lifetime analysis, and we'll try to provide more written data on this; but we do feel that the assumptions that EPA used that DOE then continued with for comparisons in the UK are inappropriate. That condensing boilers have only been in the marketplace in the U.S. since about 2000 and you just can't make the assumption that they're going to have a 25-year lifetime when none of them have been here for 25 years, and the UK comparison are based on different products. With that, thank you.

MR. BROOKMAN: Thank you. Final comments? Okay, John Cymbalsky.

MR. CYMBALSKY: Actually, this question came in earlier today and I put it in my pocket to end the meeting with for good reason because it really isn't relevant to this rulemaking. David Lis, L-i-s, asked could DOE clarify whether or not circulating pumps are considered a covered product and thus, preempting states from implementing state-level standards.

We do have an open rule on pumps and this question will be delivered to the pumps docket and dealt with in that rule.

And in conclusion, I would just like to

thank everybody. I think actually today was a very productive meeting. I learned a lot and we really do appreciate the openness of the manufacturers to share the information that they have. This is, obviously, information only you guys have. And to the extent you can and will provide it will really help strengthen the analysis and so thank you in advance for anything you can provide there.

And then for you traveling get home safe and currently the comment period closes June 1, 2015, but I can safely say you know you'll have another month at minimum at this point. So, you'll have 30 days. I can guarantee that much at this point. Please submit your comments to the email here.

MR. STAS: We'll do an extension notice in the Federal Register and probably do an email blast. It'll be on website.

MR. CYMBALSKY: Yes, we will do a Federal Register Notice. I'm still waiting for one of the extension comments to come into my email box, so I need to read them first. So, here's how you submit your comments so that the docket's really important there and we look forward to receiving your comments and thanks again.

(Whereupon, the meeting was conclude at 4:41 p.m.)

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