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Case: Energy Conservation Standards: Preliminary Analysis For
Commercial Packaged Boilers Meeting



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Fax: 202-737-3638
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UNITED STATES DEPARTMENT OF ENERGY

ENERGY CONSERVATION STANDARDS:

PRELIMINARY ANALYSIS FOR
COMMERCIAL PACKAGED BOILERS

PUBLIC MEETING

TUESDAY, DECEMBER 9, 2014

FORRESTAL BUILDING, ROOM 8E-089

1000 INDEPENDENCE AVENUE, S.W.

WASHINGTON, D.C.

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1 GROUPS MEMBERS/PARTICIPANTS:

2 Doug Brookman, Public Solutions

3 Jim Raba, U.S. Department of Energy

4 Chuck White, Plumbing-Heating-Cooling

5 Contractors National Association

6 Frank Stanonik, Air Conditioning, Heating and

7 Refrigeration Institute

8 Rohit Andhare, Navigant Consulting, Inc.

9 Eric Stas, U.S. Department of Energy

10 Adam Darlington, Navigant Consulting, Inc.

11 Rupam Singla, Lawrence Berkeley National

12 Laboratory

13 David Winiarski, Pacific Northwest National

14 Laboratory

15 Felipe Leon, Pacific Northwest National

16 Laboratory

17 Alex Lekov, Lawrence Berkeley National

18 Laboratory

19 Harvey Sachs, American Council for an

20 Energy-Efficient Economy

21 Andrew Allen, Navigant Consulting, Inc.

22 Ashley Armstrong, U.S. Department of Energy

1 GROUPS MEMBERS/PARTICIPANTS:

2

3 By Telephone:

4 Geoffrey Halley, American Boiler Manufacturers
5 Association

6

7 Joanna Mauer, Appliance Standards Awareness
8 Project

9 Robert Glass, Raypak, Inc.

10 Jeff Kleiss, Lochnivar, LLC

11 Frank Myers, PVI Industries, LLC

12

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1 P R O C E E D I N G S

2 9:07 a.m.

3 Welcome and Introductions

4 MR. BROOKMAN: Good morning everyone,
5 welcome. This is the United States Department of
6 Energy's Energy Conservation Standards Preliminary
7 Analysis for Commercial Packaged Boilers meeting.
8 Today is December 9th, 2014, here in Washington, D.C.
9 in the Forrestal Building.

10 My name's Doug Brookman, Public Solutions,
11 Baltimore. Nice to see you here this morning. We're
12 going to start with welcoming remarks from Jim Raba.

13 MR. RABA: Good morning everyone, and
14 welcome. Whether you're attending today this public
15 meeting in person or via the webinar, this is the
16 U.S. Department of Energy's public meeting about
17 commercial packaged boilers, where we'll address our
18 preliminary analysis of this equipment.

19 The purpose of the preliminary analysis is
20 to address the methodologies and characterize the
21 results thus far for those analyses, discuss
22 particular issues related to each of the analyses,

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1 encourage input from interested parties, comments,
2 data and relevant information about the
3 methodologies, assumptions and data sources, and
4 address the next steps in the Department of Energy's
5 rulemaking process.

6 My name is Jim Raba. I'm the Project
7 Manager for Commercial Packaged Boilers, and I'll be
8 today's Presiding Officer. Moreover, the real
9 expertise behind this rulemaking process is from
10 Lawrence Berkeley National Laboratory and Navigant
11 Consulting.

12 Today some of our team members are Rupam
13 Singla, Alex Lekov, Rohit Andhare, Andrew Allen, Adam
14 Darlington. General Counsel for the Department of
15 Energy is Eric Stas. The Appliance Standards Program
16 Manager is John Cymbalsky. Our facilitator at
17 today's public meeting, is Doug Brookman, President
18 of Public Solutions, a mediation company. Doug is
19 our go-to guy for public meetings such as this.

20 MR. BROOKMAN: No.

21 MR. RABA: Doug, over to you. Thank you.

22 MR. BROOKMAN: We always start with

1 introductions. Please state your name and organizational
2 affiliation. You can get used to turning the microphones
3 both on and off.

4 MR. WHITE: My name is Chuck White. I'm
5 Vice President of Technical and Code Services for the
6 Plumbing-Heating and Cooling Contractors National
7 Association.

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

10 MR. SACHS: Harvey Sachs, American Council
11 for an Energy Efficient Economy.

12 MR. DARLINGTON: Adam Darlington, Navigant
13 Consulting.

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

16 MR. RABA: Jim Raba, DOE.

17 (Off mic introduction.)

18 MR. RABA: It's okay, please.

19 (Off mic introduction.)

20 MR. ALLEN: Andrew Allen, Navigant
21 Consulting.

22 MR. LEKOV: Alex Lekov, Lawrence Berkeley

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1 National Laboratory.

2 MS. SINGLA: Rupam Singla, Lawrence
3 Berkeley National Laboratory.

4 MR. LEON: Felipe Leon, Pacific
5 Northwest National Laboratory.

6 Meeting Overview

7 MR. BROOKMAN: Thank you. Thanks to all
8 of you, and when you are responding to questions
9 during the course of the meeting, we'll use that
10 microphone, okay. All of you received a packet of
11 information as you checked in this morning. I'm
12 going to do a very brief agenda review. You can see
13 it's Slide No. 4 in your packet.

14 Immediately following this agenda review
15 and a few other preliminary matters, there's an
16 opportunity for anybody that wishes to make brief
17 opening statements here at the outset, issues that
18 you wish to raise here that are important to be
19 featured from your perspective here at the outset.

20 Following that, we're going to move into a
21 description of the regulatory authority and
22 rulemaking overview, and moving directly to Market

1 Technology Assessment and Screening Analysis, then
2 Engineering Analysis. We'll take a break
3 mid-morning, around about 10:45, wherever we are in
4 the content at that point.

5 Returning from the break or whenever we
6 get there, Markups, Energy Use Characterization and
7 then LCC and Payback Period Analyses. Lunch today
8 around about noon. I'll describe the logistics
9 surrounding lunch when we get there, and then
10 returning from lunch, LCC and Payback Period
11 Analysis, continued. National Impact Analysis.

12 We'll take a break mid-afternoon as
13 needed, around about 2:15, 2:30 or so, and then
14 moving on, Preliminary Manufacturer Impact Analysis, Next
15 Steps. And then at the end of the day, whenever we
16 arrive there, another opportunity for closing
17 remarks. Any other issues that need to be raised at
18 that point, that you think may not have been covered
19 sufficiently.

20 If you look at page two in your packet,
21 these are the suggested norms that we'd ask that you
22 please speak one at a time. You can turn the

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1 microphone on and off as you've gotten used to doing
2 already.

3 Please say your name for the record each
4 time you speak. They'll be a complete transcript of
5 this meeting. If you could be concise to share the
6 air time and keep the focus here. If your cell
7 phones are not on silent already, please turn them on
8 silent and limit sidebar conversations.

9 Webinar participants, we welcome you. As
10 Jim Raba has said, please turn your telephones on
11 mute. You can raise your hand in the software that
12 has been provided to be recognized to speak.

13 We ought to be able to hear you in the
14 room. It's been pretty good of late, so you can
15 participate in this meeting real time. And as moving
16 on through this packet, the Department of Energy is
17 broadcasting this public meeting live over the
18 Internet for interested parties, and I understand we
19 have about 13 or 15 individuals on the line today.

20 We welcome you and want you to participate
21 in this meeting as you wish to, and all interested
22 parties, both here in person and on the web are

1 encouraged to submit written comments after the
2 public meeting. That's really critical for the
3 Department, to get a good handle on what the concerns
4 of stakeholders are.

5 So then do you wish to introduce the next
6 element?

7 MR. RABA: Sure. Well good morning. This
8 is Jim Raba again. This is a time we customarily
9 look to you for any opening statements you wish to
10 make in your remarks. At this time, we invite anyone
11 to share those opening remarks or statements about
12 DOE's preliminary analysis for commercial packaged
13 boilers.

14 So I invite -- does anybody wish to make
15 an opening statement or brief comments at this time,
16 here live or on the webinar?

17 (No response.)

18 MR. BROOKMAN: I see no one in the room.
19 Okay. Then let's proceed with the content in the
20 packet. Okay.

21 MR. RABA: You see here on the screen an Issue
22 Box, and as we will do throughout the public meeting

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1 today, have boxes like this, to encourage your
2 comments. Now during today's presentation,
3 particular issues are prompted for discussion on slides
4 such as this.

5 Otherwise, comments about any part of the
6 presentation are welcome throughout. When you submit
7 comments, please identify the docket number and/or
8 the regulatory identifier. Comments are due by
9 January 20th, 2015, and their address is there to
10 email, postal or courier to the Department. Any
11 questions so far?

12 None seen at this time, I can introduce
13 Rohit Andhare, who will talk today now about some of
14 the overview, the definitions and other background
15 information about our presentation today, and the
16 preliminary analysis.

17 Background Information

18 MR. ANDHARE: All right. Good morning
19 everyone. So I'll start with the introduction and
20 the overview. The first thing is the regulatory
21 authority. There are four Acts which are relevant to
22 the current rulemaking. The first one is EPCA of

1 1975. This Act brought about, started the energy
2 conservation standard program at DOE.

3 The second is EPACT of 1992, and this Act
4 brought commercial packaged products as a type of
5 equipment for the rulemakings. Then we have EISA and
6 AEMTCA. These acts amended EPCA to have DOE review the
7 standards every six years.

8 The last rulemaking for this equipment was
9 back in July 2009. So six years from then, July
10 2015, is when by which DOE will complete its review.

11 So what is a commercial packaged boiler? A
12 commercial packaged boiler is essentially a low
13 pressure packaged boiler. It has a maximum input
14 rating capacity of 300 kBTU per hour, at least 300 kBTU
15 per hour, and it is usually used for commercial space-
16 heating applications.

17 The definitions are also on the slides,
18 and they can be used for future reference. So these
19 are the current standards that we have for commercial
20 packaged boilers, and this is the result from the
21 July 2009 rulemaking, and here we have ten equipment
22 classes.

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1 Eight of these equipment classes -- so
2 eight equipment classes are formed by classifying the
3 equipment based on the size, that is small or large,
4 the fuel input, the type of fuel, that is gas or oil,
5 and the type of output, that is hot water or steam.

6 Two of these equipment classes, that is
7 the steam gas-fired, the small and large steam
8 gas-fired boilers, are further classified based on
9 the draft type. So where do we stand? Currently we
10 are -- so we've already released the framework
11 document last year. This was back in September, and
12 then followed by the public meeting in October for
13 the framework document, and we've already released
14 the preliminary analysis TSD chapters, and the
15 comments are due by January 20th, 2015.

16 There are two rulemakings which are
17 on-going and parallel to this one. The first one is
18 coverage determination for natural draft commercial
19 packaged boilers, and the second one is the test
20 procedure rulemaking for this equipment.

21 I'd like to note over here that the analysis
22 that is covered under this presentation and in the

1 TSD chapters is based on the existing test procedures
2 which are mentioned in the CFR.

3 So here's our time line. We're at
4 Preliminary Analysis. NOPR is, as I said, it's due
5 by July 2015. This is the projected time, and final
6 rule is projected by 2016.

7 So typically when DOE does its analysis,
8 it considers these seven factors, which are mentioned
9 in EPCA, and all these factors are addressed in the
10 respective analysis. So for example, for the
11 economic impact on consumers and manufacturers, this
12 is addressed by the life cycle cost analysis and
13 manufacturer impact analysis.

14 So throughout this presentation, we'll be
15 talking about all these analysis and the results, and
16 they address these seven factors. So we're at the
17 Preliminary Analysis, and now we move on to the
18 second topic of discussion, that's the market and tech
19 assessment, and the screening analysis.

20 We'll first talk about the market --
21 sorry.

22 MR. BROOKMAN: Yes, please. Frank

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1 Stanonik.

2 MR. STANONIK: Frank Stanonik, AHRI.

3 Before we leave the time line, it's -- well, it is
4 related. I'm just curious as to can DOE give us some
5 idea of where the test procedure rulemaking and the
6 coverage determination activities fall in on this
7 time line, because -- and the reason we bring that up
8 is that from my perspective, as we have said in
9 previous comments, it is absolutely necessary that
10 the test procedure revision be done before this
11 rulemaking.

12 MS. ARMSTRONG: Can I answer that for you?

13 MR. BROOKMAN: Yeah, that's great.

14 VOICES: Identify yourself.

15 MR. BROOKMAN: Ashley Armstrong.

16 MS. ARMSTRONG: So I'm Ashley from DOE. I
17 wasn't going to say anything, but I was quietly
18 sitting in the back corner.

19 [Inaudible] I wouldn't believe that.

20 (Laughter.)

21 MS. ARMSTRONG: So we agree. We agree,
22 Frank, the test procedure NOPR is expected to come

1 out, I would say the hope is that it will be out
2 early next year. So you will likely see that well in
3 advance. We're trying to get the preliminary
4 analysis out, trying to get some feedback and some
5 additional data to incorporate into the NOPR.

6 To the extent we make revisions to the
7 test procedure that would impact the measures,
8 obviously they would be rolled into the NOPR
9 analysis, as well as any data. But we wanted to make
10 sure we got this out as early as possible, to start
11 the process of getting some data and good feedback,
12 okay.

13 MR. BROOKMAN: Thank you, Ashley.
14 Additional questions before we move on? No, okay.

15 MR. RABA: We're moving on.

16 MR. BROOKMAN: All right.

17 Market Impact Assessment/Screening Analysis

18 MR. ANDHARE: So our second topic of
19 discussion is market and tech assessment and screening
20 analysis. We'll first do the market impact
21 assessment. The purpose of the market and technology
22 assessment is to understand the market, to see how

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1 can we divide the equipment into equipment classes,
2 and then we look at the voluntary regulatory programs
3 that are ongoing for this equipment.

4 We also look at the manufacturers and the
5 trade associations, which are dealing in this
6 equipment, and then we look at what are the
7 constituents of -- what are the components of a
8 commercial package boiler. Once we have that
9 information, we then go on to identifying the
10 technology options that will improve the efficiency
11 of the boiler.

12 So for the first step, we first divide the
13 equipment based on the ten equipment classes. So
14 here we have 16 equipment classes. Three of those
15 are based on the four factors which are involved for
16 the classification. The first one is the size, the
17 small or large. The second is the type of fuel
18 input, that's whether gas or oil. The third is based
19 on the output, that is hot water steam, and the
20 fourth one is also based on mechanical draft or
21 natural draft.

22 So the scope of the current rulemaking

1 includes all commercial boilers that have an input
2 capacity of at least 300 kBTU per hour, and they also
3 include all the factors that I talked about, whether
4 it can be fired by gas or oil, and that's natural gas
5 or propane, and mechanical draft or natural draft in
6 hot water or steam or both.

7 Here, we will not be addressing electric
8 commercial package boilers, and this is because most
9 of these boilers already reach 100 percent efficiency.
10 So there is very small scope for efficiency
11 improvement and negligible energy savings.

12 We will also not be looking into standby
13 mode and off mode energy conservation standards.
14 Again, according to our estimates, the standby mode
15 and off mode contribute to very low energy
16 consumption, and most of it is consumed during the
17 active mode of the boiler. We will also not be
18 setting an upper limit for regulating the commercial
19 package boilers.

20 So once we have -- we have classified the
21 equipment based on equipment classes, we then go on
22 to the analysis. So we hit -- we went through each

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1 and every equipment class, and looked at what are the
2 kind of input ratings there are in each equipment
3 class. What are the efficiency levels that we see;
4 what are the kind of materials that are used.

5 So these are some factors that we looked
6 at for each equipment class. Here is a sample result
7 of the first equipment class that we looked at,
8 that's the small gas-fired mechanical draft hot water.
9 So you will see these charts in the Chapter 3 of the
10 TSD, and over here in the first --

11 In the first chart we have the average
12 thermal efficiency. So what we did was we divided
13 all the equipment class based on small input rating
14 categories, and then analyzed the efficiencies in
15 each of these categories.

16 We also looked at the percentage of the
17 distribution of boilers based on the materials. So
18 for this equipment class, we can see that 62 percent
19 is based on copper. And finally, the last chart at
20 the bottom shows the distribution of the boilers,
21 based on thermal efficiency.

22 So we divided the boilers into condensing

1 and non-condensing, and we saw where most of the
2 boilers lie, at what efficiencies most of them
3 perform.

4 MR. BROOKMAN: Harvey Sachs.

5 MR. SACHS: This is Harvey, and as I go
6 back to Slide 20, the last bullet says there's no
7 upper limit of input capacity set for regulating
8 commercial packaged boilers.

9 MR. ANDHARE: Yes.

10 MR. SACHS: And it's just having sat
11 through a great deal of discussion of this issue in
12 the Certification and Compliance and Enforcement
13 Negotiated Rulemaking in 2013, I came away somewhat
14 struck by the challenges in actually assuring CC&E
15 for very, very large boilers, and wonder if we're
16 going to have regulation without enforcement or if
17 the Department is planning ahead to enforcement for
18 say 10 million Btu boilers?

19 MR. BROOKMAN: Eric Stas.

20 MR. STAS: Eric Stas, DOE. I mean as you
21 know, the standards currently have no upper limit,
22 and then we're confronted with the provision of 42

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1 U.S.C. Section 6095.01, which says that the Secretary
2 can't issue a standard that decreases energy
3 efficiency or increases the maximum allowable energy
4 use, you know, commonly referred to as an
5 anti-backsliding provision. So we have that to
6 contend with.

7 So that's why we're not considering an
8 upper limit on the capacities at this time. However,
9 I'm sure there are mechanisms available to look at
10 how these units, larger units would be tested. AEDMs
11 is one thing that comes to mind.

12 So I think the Department is sensitive to
13 those concerns and, you know, we look for comments on
14 how to address those type of concerns.

15 MR. BROOKMAN: Eric, would just spell out
16 AEDM?

17 MR. STAS: Alternative --

18 MR. BROOKMAN: Energy Determination
19 Method?

20 MR. RABA: This is Jim. Alternative Efficiency
21 Determination Method.

22 MR. BROOKMAN: Thank you. Okay, thanks.

1 Okay, Harvey.

2 MR. SACHS: I think we have a record now.

3 Thank you.

4 MR. BROOKMAN: Okay. All right.

5 MR. ANDHARE: So once we have market
6 analysis results, we then go on to identifying what
7 are the components involved in the operation of a
8 boiler. So the slide shows the basic components that
9 are involved. So it's identified by gas or oil for
10 our case at least, for our rulemaking at least, and
11 for oil it will use an oil pump and an atomizer.

12 The atomizer sprays the oil into the air,
13 and it can be either a mechanical draft system or a
14 natural draft system. A mechanical draft would
15 either have a forced draft fan blower or it could
16 have an inducer draft fan.

17 Then there are burners. The burners can
18 be of a single stage, double stage or it can be
19 modulating. The burners ignite the air gas or
20 and oil mixture, and this -- and it transfers -- and
21 the flue gases transfer heat to the water in the
22 heat exchanger.

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1 The heat exchanger can also have multiple
2 designs. It can have multiple materials, cast iron,
3 stainless steel, copper fin, copper tube, or fire-
4 tube boilers. It can have multiple designs as well,
5 and the primary mode of heat transfer is convection
6 and radiation.

7 Once the heat is transferred, the flue
8 gases are vented out through the flue stack. For
9 natural draft, we also have vent damper. This is
10 the basic model of the boiler, and we now -- once we
11 know this, now we can identify how we can improve the
12 efficiency of the boiler.

13 So these are the technology options that
14 DOE identified for improving the thermal or
15 combustion efficiency. Most of the concentration is
16 on improving the heat exchanger, so either improving
17 the fin tube design or the surface features, and
18 also there's an interest in looking at improvements
19 in burner technology. So there is an option for
20 premix burners or low pressure air-atomized burners.

21 So that completes our market and tech
22 assessment, and we have some issues of comment.

1 You'll take them? Doug?

2 MR. BROOKMAN: No, please.

3 MR. ANDHARE: So there are two issues for
4 comment over here. The first one is the DOE seeks comment
5 about the scope and technology options to improve
6 combustion and/or thermal efficiency, and the second
7 issue is DOE seeks comment on the appropriateness of its
8 decision to -- tentative decision to classify
9 commercial boilers into 16 equipment classes.

10 MR. BROOKMAN: So it's useful to get
11 comment on this particular item, particularly Issue
12 2. Especially if you like what the Department has
13 done, it's useful to indicate that. Frank Stanonik.

14 MR. STANONIK: Frank Stanonik, AHRI. On
15 Issue 1, I mean I think we've provided comments
16 before. You know, if we're sitting here ten years
17 ago, burner derating was still a practical option.
18 But between efficiency standards and demands of the
19 market, our perspective is that most products have
20 been --

21 You know, that was one of the easiest and
22 first things that people did to improve the

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1 efficiency of their models. So we don't really see
2 that there's much room for further burner derating of
3 boiler models on the market today. So we really
4 think that particular technology option has kind of
5 been there, done that, as opposed to still viable --
6 still providing some significant benefit.

7 Other than that, again, we've said, for
8 whatever reasons -- I mean we've said many things.
9 Pulse combustion is just another way to get a
10 condensing boiler. We really don't see it as a
11 distinct technology. But just, I guess just make
12 that statement.

13 Issue 2, I guess I'm missing something,
14 because when I looked at Slide 12, I got two, four,
15 six, eight, ten classes. How did we get to 16? What
16 am I missing?

17 MR. BROOKMAN: Back to Slide 19.

18 MR. STANONIK: Okay.

19 MR. ANDHARE: Here, there are 16.

20 MR. STANONIK: Okay, okay. I got it, yep,
21 yep. At this point, we'd certainly agree you can
22 start from there. As the analysis goes forward, we

1 may find out you can squeeze some together. But I
2 guess for the preliminary analysis, we would agree
3 you have to look at it this way.

4 MR. BROOKMAN: Okay. Thank you, Frank.
5 Additional thoughts on Issue No. 1 and 2? Nothing
6 additional.

7 MR. ANDHARE: Okay. So --

8 MR. BROOKMAN: Harvey Sachs.

9 MR. SACHS: This is Harvey Sachs, and it
10 relates here and it will come up again. But the
11 decision not to really look at modulating burners or
12 multi-stage burners is driven by the defects in the
13 current test procedure, and we think we need in the
14 market analysis in particular to continue to look at
15 the market share and penetration of these, since we
16 anticipate that the next rating method, test method
17 will show the benefits in the field of the use of
18 modulating burners in raising the efficiency, the
19 reported efficiency.

20 So I think that I'm uncomfortable with the
21 decision not to look at modulating burners, but
22 instead just to consider them baseline technology.

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1 MR. BROOKMAN: Okay, thank you. Do we
2 have any additional thoughts on modulating burners?

3 MR. ANDHARE: I'd like to supply. So we
4 do look at modulating burners in the market
5 assessment. For example, go here in the bottom
6 slide. We actually look at the distribution of
7 burners that are modulating and are condensing and
8 modulating, and are non-modulating. So we do look at
9 it in the market and assessment stage and then, you
10 know.

11 The other thing is that current test
12 procedure does not -- it doesn't matter if it's
13 modulating or not, because it has to operate at the
14 full input rating capacity.

15 MR. SACHS: This is Harvey. I appreciate
16 that the test procedure is a full load test, and
17 that's why it is so totally obsolete, and I very much
18 appreciate that you're including this in the market
19 analysis.

20 MS. ARMSTRONG: So I'm going to turn the
21 question back to you for a second, and maybe to Frank
22 too. This is Ashley from DOE. I don't know how far

1 the discussions have gone within the HI Committee at
2 AHRI about moving to a part load. Initially, there
3 was some discussion. We also teed it up in the RFI
4 about moving to potentially a part-load type test.

5 Not to hijack the standards presentation,
6 but -- and there was some, I would say, caution of
7 moving to a part-load test, one from the test program
8 standpoint, but two, at least for this round of rule.
9 I was just was wondering if the HI Committee had come
10 -- I know you were both on the HI Committee. So I
11 don't know if the HI Committee has made any further
12 progress with what they're doing.

13 That's not to say DOE has made it --
14 obviously, DOE has made some internal decisions about
15 what they're doing, but I would be interested to
16 know.

17 MR. STANONIK: Frank Stanonik, AHRI, and
18 HI is the Hydronics Institute section of AHRI.
19 Actually, at this point, our members are much more of
20 the opinion that for this particular process, both
21 this standard rulemaking and the test procedure
22 rulemaking, that we not get into the complexity of

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1 part load.

2 And so that is something we see as will be
3 ultimately addressed by the ASHRAE Standard 155, and
4 in the interim, the industry would -- until that gets
5 finalized, which will still take some time. Our
6 position would be that we proceed with the procedures
7 that we have, which at the moment don't look at part
8 load and that this rulemaking also deal with that
9 situation.

10 So we recognize that it will ultimately --
11 there will be procedures that include some part load
12 measures. But we see that as the culmination of the
13 155 activity, and we just don't see that that will be
14 done in time for either of these rulemakings.

15 MR. SACHS: This is Harvey, and I'm scared
16 to say what I'm going to say. ASHRAE 155 spent
17 almost 15 years delivering a standard that was
18 stillborn. It could not be implemented. AHRI and HI has
19 been working on 2000, at a pace that continues, and
20 at this point we feel that we're running out of time.

21 We're running out of time relative to
22 what's happening elsewhere in the world, and relative

1 to the need to reduce the fuel consumed for all sorts
2 of reasons, economic and environmental.

3 Although I'm going back to my colleagues,
4 I think there needs to be a strong signal that if our
5 friends in the consensus community, which includes
6 me, don't get their act in gear by a firm date, DOE
7 will issue its own standard that reflects the value
8 of part-load capability.

9 To customers and the industry, it's not
10 choosing what to design and what to select on our
11 building-based applications.

12 MS. ARMSTRONG: I'm going to ask one
13 follow-on, to put you a little bit on the spot, and
14 don't feel like you need to answer it here. But I
15 will ask perhaps that you consider what that time
16 frame might look like for DOE to consider.

17 MR. SACHS: Well Ashley, this is Harvey,
18 and having cast asparagus at AHRI and ASHRAE, I have
19 to do the same to DOE, and say that if y'all hadn't
20 -- had started investing and doing appropriate fuel
21 measurements 20 years ago, we'd know what we needed.

22 Now, just as with residential light

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1 commercial water heating, water heaters, we have a
2 real deficit in knowledge, and at some point,
3 somebody's going to have to say we're jumping in.
4 We're doing the best we can. It's going to work for
5 the next decade while we embark on an aggressive
6 program of fuel monitoring, to find out what the hell
7 is happening. End of rant.

8 MR. BROOKMAN: Additional comments here
9 before we move on?

10 MR. STANONIK: Frank Stanonik, AHRI.
11 Certainly the issue of what regulations require, what
12 test procedures require have significant impacts.

13 But I just want to note that for whatever
14 it's worth, in ASHRAE Standard 90, which covers
15 energy and conservation in commercial buildings,
16 there's actually been requirements for quite some
17 time, that requires controls for the boiler-based
18 heating system, that in fact tried to manage the
19 firing according to the load. That's been there in
20 Standard 90 for a while.

21 So you know, whether I guess my point here
22 is, you know, whether or not there's today a test

1 procedure for part load, there have been other
2 factors in the market that I think, as you mentioned
3 here, you know, there are a number of models that
4 have modulating controls.

5 MR. BROOKMAN: Thank you.

6 MR. STANONIK: I guess the savings is
7 happening.

8 MR. SACHS: This is Harvey, and again, I'm
9 ahead of my community. I'm casting a blank shell
10 across the bow. But I think this is an area which we
11 are going to emphasize. I think BTS-2000 is an
12 entirely appropriate approach for some industrial
13 applications. Buildings have climate. I think that
14 we just don't know what we see, and this is one of
15 the areas for the market assessment also.

16 We think we see some shift from using
17 larger boilers, for which we can't get good use
18 information, good information on how they utilize
19 energy in the field at part load, because we don't
20 measure it, toward using trains of smaller boilers,
21 and this is going to have some impact on the market
22 also.

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1 So I think this is an absolutely first
2 order issue for the industry, as well as the
3 purchasers and users. At the same time, I think this
4 proceeding must proceed getting the information
5 required for doing -- for working with a revised test
6 method. But I am not now asking for delay in this
7 proceeding.

8 MR. BROOKMAN: Okay. Thanks, Harvey.
9 Okay.

10 MR. ANDHARE: All right, thank you.

11 MR. SACHS: This is Harvey again. One
12 last time on this. I will submit into the record an
13 ASHRAE journal article from almost a decade ago from
14 Durkin, reflecting the challenges that customers in
15 commercial buildings have in choosing equipment and
16 then selling the choice of the more efficient
17 equipment, given the defects in the standard.

18 MR. BROOKMAN: Thank you.

19 MR. ANDHARE: All right. So we now go to
20 the screening analysis. So in the screening
21 analysis, we screen out technologies which fail
22 certain criterias that DOE sets. There are four

1 criterias, and those are mentioned in the slide.

2 I'll just repeat them: That's technological
3 feasibility, practicability to manufacture and
4 install, and the adverse effects on equipment utility
5 and human health.

6 These are the technology options that pass
7 the screening test. The box on the left shows these
8 options, and as I mentioned earlier, the interest was
9 in looking at options which improve heat exchanger
10 performance, and this involves innovative fin designs and
11 even looking at surface enhancement features.

12 We also looked at burners, how can we
13 improve the burner performance, there are the three options
14 that I mentioned earlier. The burner derating has an
15 adverse impact on the end user, because the end user
16 would get a lower utility from the boilers. So
17 that's why it's not included. It failed the
18 screening test.

19 There are some options over here which
20 passed the screening test but were not considered by
21 DOE, and this is mainly because the current -- based
22 on the current test procedure, there is negligible or

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1 a very low impact on the energy savings or efficiency
2 improvement. So these are the options, and we now
3 have issues for comment.

4 So DOE is interested in views about the
5 technological and economic feasibility of the
6 technology options which successfully passed the
7 screening test. Do you have any comments?

8 (Off-mic comment.)

9 MR. BROOKMAN: Okay. No comments here,
10 and in particular nothing that was missed here in
11 this Slide 27.

12 (No response.)

13 MR. BROOKMAN: No. Okay, thanks. Okay,
14 moving on.

15 MR. ANDHARE: Okay. So now we go to our
16 third topic of discussion, the engineering analysis.
17 So the purpose of the engineering analysis is to
18 establish the relationship between the manufacturer's
19 selling prices and the efficiency levels. The
20 results that we obtain from the engineering analysis
21 go into all the downstream analysis like life cycle
22 cost analysis, energy use, Manufacturer Impact

1 Analysis and National Impact Analysis.

2 So for getting the information for this
3 analysis, we looked at different sources, and our
4 main source of information was the prices that we got
5 from manufacturers and contractors to carry out this
6 analysis.

7 MR. SACHS: As a matter of record, this is
8 Harvey again, AC Triple E notes that the upper graph
9 of the analysis are based in a snapshot in time,
10 although it's much less relevant for this very mature
11 set of technologies with large international firms
12 involved, than it is for some products.

13 We would note for the record that DOE has
14 consistently underestimated the changes in cost for
15 advanced technologies as they became standard
16 products or lower-priced premium products with
17 advances in the standards. I think this conceptual
18 model has to be qualified as being a snapshot rather
19 than a movie, as people do their thinking.

20 MR. BROOKMAN: Okay, thank you.

21 MR. ANDHARE: Thank you. So there are
22 several steps that we follow to carry out the

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1 engineering analysis, and I'll be discussing about
2 these steps more in detail. But they're on your
3 screen for a quick view. So we first will talk about
4 the baseline models.

5 So the first step is to identify what are
6 the baseline efficiencies. For our case, for our
7 rulemaking, we've used the baseline efficiencies
8 based on the current energy conservation standards
9 for this equipment.

10 So we also -- the other thing that we also
11 look at is the common technologies that are used in
12 baselines, and this helps us validate if there is an
13 efficiency improvement, then what is that, because
14 what is -- why did that improvement occur?

15 So for example, if there is a much better
16 burner, then we know that the efficiency improvement
17 is because of that burner. So it kind of helped us
18 validate our findings, and here on the screen we have
19 the baseline efficiencies. I would also like to
20 point out that we'll be using some acronyms to
21 describe the equipment classes.

22 So for example, SGMDHW would refer to a

1 small gas mechanical draft hot water, and they're on
2 your screen for your view.

3 MR. BROOKMAN: Before you move on, Joanna
4 Mauer, who's joining us via the web, has a question
5 is could DOE explain the rationale for considering
6 separate equipment classes for mechanical draft and
7 natural draft boilers?

8 MR. DARLINGTON: Well I mean so --

9 MR. BROOKMAN: Adam Darlington.

10 MR. DARLINGTON: Adam Darlington,
11 Navigant. Sorry. So regarding the steam classes,
12 the natural draft and mechanical draft are already
13 separated in the current standards. The other
14 classes are not currently separated by the standards.

15 But I think as was explained a few slides
16 ago, we're analyzing 16 product classes on the basis
17 of the coverage determination that DOE is making,
18 where DOE is, I guess, doing the cover determination
19 to clarify its authority to cover the natural draft
20 product classes. So -- and Eric, you can chime in on
21 the legal opinion. But I think that they have to be
22 separated because of that.

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1 MR. BROOKMAN: Eric, do you want to --

2 (Off mic comment.)

3 MR. BROOKMAN: Okay.

4 MR. DARLINGTON: So it has to do with the
5 coverage determination and keeping them separate.

6 MR. BROOKMAN: Okay. Okay, thank you
7 Adam. Thank you. Okay.

8 MR. ANDHARE: So
9 then we move on the next step, that is determining
10 the intermediate and max tech efficiency levels. So
11 the intermediate and max tech efficiency levels are
12 -- they identified from the commonly available efficiency
13 levels that we see on the market, and on the bottom
14 over here, the tables, the boxes you can see the
15 efficiency levels that we'll be looking at, and we'll
16 be analyzing all classes, incremental prices for all
17 these.

18 The reference point is of course the
19 baseline. We will be looking at the efficiency
20 improvement from the baseline and also the
21 incremental price from the price of baseline models. We're
22 also looking at the condensing efficiency levels. So

1 all efficiency levels that have -- that are above 90
2 percent are condensing boilers efficiency levels.

3 So after that we move on to collecting the
4 data, and as I mentioned -- sorry yes.

5 MR. STANONIK: Frank Stanonik, AHRI. So
6 on this slide, and I'll apologize, I've not read the
7 whole TSD yet. So are these the standard trial
8 levels that you're going to be looking at?

9 MR. DARLINGTON: Adam Darlington,
10 Navigant. So these are the efficiency levels.

11 MR. STANONIK: Yes.

12 MR. DARLINGTON: And so when we get to the
13 NOPR phase, we'll construct the trial standard levels
14 out of combinations of these efficiency levels. Is
15 that --

16 MR. STANONIK: Okay. So I guess I'll ask
17 my question. Then maybe you can -- well, I'll ask
18 the question. So as an example, in the, let's see,
19 small oil mechanical draft hot water, I mean you go
20 from 87 to 98, and there's no question making a
21 condensing oil product has many challenges to it.

22 But having said that, you know, why no

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1 interim point? I mean there's a huge -- it's like
2 you went from the maximum non-condensing level to
3 really what would be, I would say actually the
4 practical absolute maximum on a condensing level,
5 with no interim values. Why?

6 MR. DARLINGTON: So these were based on --

7 MR. BROOKMAN: Adam Darlington.

8 MR. DARLINGTON: Oh sorry, Adam
9 Darlington, Navigant. So these are based on our view
10 of the market. I can't recall exactly what's out
11 there Frank, but so the 98's included because it's
12 the max tech, and there's a legal obligation to look
13 at the max tech.

14 As far as an intermediate level, I mean if
15 you think an intermediate level should be there,
16 we'll certainly take that under consideration and
17 look again, and potentially add one for the NOPR.

18 MR. STANONIK: Okay, Adam. I think your
19 answer that you've looked at what's out there really
20 kind of explains that. Again there's, at the moment,
21 for that particular class of products, not much out
22 there. Okay, thank you.

1 MR. STAS: And if you have data to
2 back up that suggestion, that would be most welcome.

3 MR. BROOKMAN: Thank you, Eric.

4 MR. SACHS: This is Harvey, and I think
5 the inclusion of the low level condensing in the
6 analysis will illustrate the challenges faced in
7 marketing such a product, at a cost-effective price,
8 and it's worth doing for that reason alone.

9 MR. BROOKMAN: Okay, thank you.

10 MR. ANDHARE: So the data, the price data
11 that we received from contractors and manufacturers,
12 as we can see, was quite skewed. We received most of
13 the prices for mechanical draft equipment, while very
14 low prices were received for the natural draft.

15 So it's important to mention here that DOE
16 requires to give us a singular set of results from
17 the engineering analysis, and when we received the
18 prices, they're distributed over a large range of
19 input capacities and over a large range of
20 efficiencies. So it's important to define a
21 representative input capacity for every equipment
22 class, and we chose -- we've identified for

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1 small-sized boilers, for small-sized equipment class
2 as 800 kBTU per hour and for large size as 3,000.

3 These are based on the input ratings that
4 have the maximum number of shipments, annual
5 shipments. So these are the capacities and all the
6 results that are covered in this chapter, in the
7 engineering analysis chapter, are based on these
8 input ratings.

9 MR. SACHS: Harvey Sachs. I'm going to
10 leave here with my reputation as curmudgeon fully
11 consolidated. But it does seem to me that at some
12 point, there are very few customers interested in
13 buying input capacity. The level field for comparing
14 purchase options is output capacity, and it's with
15 the advent of very high efficiency equipment.

16 It seems to be about time to migrate to
17 looking at output capacities that are comparable
18 across classes rather than input capacities. Now I
19 don't know if we have to change the law to get there,
20 but I think that would be within the discretion of
21 the Department.

22 MR. BROOKMAN: Yeah, thank you. Frank.

1 MR. STANONIK: I'm going to venture into
2 something I really don't know a lot about, and
3 probably something that our friends from the American
4 Boiler Manufacturers Association should be
5 addressing.

6 But I have a really strong suspicion that
7 when you're getting into this question of prices and
8 so on, that when I go from a large boiler that's like
9 three million BTUs, to the point where I'm talking
10 about, since this is unlimited capacity, since I
11 started talking about boilers that are in the tens of
12 -- potentially tens of millions of BTUs, I think
13 you're dealing with a whole different price
14 structure.

15 So I mean it's -- I don't have a good
16 sense of how significant this is, but I would just
17 caution that as you go through the analysis, that
18 there may be an upper limit on the large boiler
19 capacity, at which point you change price structures
20 just completely.

21 I mean, you know, people who as a matter
22 of -- companies as a matter of course that are making

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1 boilers, where perhaps their smallest model starts at
2 ten million and goes up from there, I think you're
3 dealing with a totally different price customer
4 situation vis-a-vis, as you said here, you know, the
5 most popular size seems to be three million BTUs.
6 Anyhow, just a little caution.

7 MR. ANDHARE: Okay, thank you. So now we
8 go on to the methodology, and based on the amount of
9 prices that we received for the different equipment
10 classes, we have classified the methodology into five
11 parts. The general approach caters to those
12 equipment classes for which we had sufficient pricing
13 information, and I'll be discussing about all these, you
14 know, one after the other.

15 So when we first look at the general
16 approach, there are six steps to be followed in this
17 approach. The first one is to -- we divided all the
18 products based on the equipment classes, all the 16
19 equipment classes, and then we identified the
20 efficiency levels that we required the intermediate
21 and max tech efficiency levels.

22 Then we pick the boilers at the representative

1 input
2 capacity. So if for a small equipment class we have
3 800 kBTU input capacity boilers at their respective
4 efficiency levels, we picked those directly. If
5 there aren't any of those boilers, then we use some
6 statistical and regression techniques to evaluate the
7 price at that capacity.

8 After that, we pick the boilers at the
9 baseline efficiency levels, and that determines our
10 baseline price. We use this price in the next step
11 to calculate the incremental price. So for example,
12 so we first divide the set into different
13 manufacturers, and then if, for example, for
14 Manufacturer A we have a boiler at 82 percent, which
15 has a price of -- which has some price, and we have a
16 baseline price, we subtract the baseline price from
17 that higher efficiency model.

18 We do this for all the manufacturers, and
19 then we average it out and we get the price
20 efficiency curve. This is the -- all this description
21 is given in the TSD chapter as well, and the results
22 are also in it.

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1 So that was for the classes for which we
2 had sufficient information. But there are some
3 classes for which we do not have sufficient
4 information, and these are the large gas mechanical
5 draft steam and large oil mechanical draft steam. So
6 these -- the prices for these were based on the
7 equipment classes for which we got the incremental
8 prices.

9 So for example, over here we have the
10 small gas prices, the incremental prices for the
11 small and large gas mechanical draft hot water. So
12 we took the ratio between the incremental prices and
13 averaged the ratio, and we used this average ratio to
14 calculate the incremental price for the large gas
15 mechanical draft steam. The small gas mechanical
16 draft steam was already obtained through our general
17 approach methodology. You had a question?

18 MR. SACHS: This is Harvey. Does that
19 scare you?

20 MR. ANDHARE: Well, we have to deal with
21 whatever prices we had, and we had to --

22 MR. SACHS: It seems to me, and Mr.

1 Stanonik's comment a minute or two ago, sort of
2 relates to my own sense. I suspect we're going down
3 orders of magnitude in numbers of products produced
4 per year, as we move from the 800 kBTU to the ten
5 million BTU product.

6 So we're doing something that looks
7 analogous to extrapolating from Cadillacs to the cost
8 of large excavators, of the class used for strip
9 mining coal.

10 I would personally be really scared, but
11 you've certainly looked at the data much more closely
12 than I have. I'm speaking from intuitions about
13 manufacturing processes. That stuff is custom
14 designed for specific applications.

15 MR. BROOKMAN: Robert Glass, who is
16 joining us online, writes the comment that is similar
17 to Harvey's last comment. He says "To support Frank
18 Stanonik's comment, made to order units will be
19 priced higher, due to the engineering work necessary
20 to create this 'one of a kind model.'" Adam
21 Darlington.

22 MR. DARLINGTON: Adam with Navigant. Just

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1 to reply or to clarify with Harvey, I mean so what
2 we're showing here is basically we're using the price
3 efficiency results from one comparison of small to
4 large, and looking at the change there, to go from
5 another comparison of small to large. It sounds like
6 your comment was more -- and so as we explained
7 earlier, the large is a three million BTU per hour
8 boiler.

9 It sounds like the issue that you're
10 taking is more that the ten million, that we need to
11 have some additional extension to these even larger
12 boilers, and look at those completely separately from
13 the three million BTU per hour boilers?

14 MR. SACHS: I am suggesting, and thank you
15 for that clarification. But I'm suggesting that I'm
16 extremely uncomfortable, without having the
17 calibration, the restraining input of knowing the
18 number of units per year at any given capacity class.

19 At this point, you are, for example,
20 assuming a linear regression in both the ones for
21 which we have data and the ones for which you don't
22 have data, and I suspect with those small numbers,

1 that we could find any number of fits that would come
2 close.

3 Now I may be wrong. I have not read this
4 piece of the TSD, but this just -- I think we need to
5 see a table of shipments by capacity for the industry
6 before we can have any confidence in this.

7 MR. WHITE: This is Chuck White with PHCC,
8 and certainly anecdotal. But in over 30 years as a
9 contractor, I've put in a lot of boilers, 800,000
10 BTUs, that type of size. Three million BTUs is 75 to
11 80 horsepower, probably ten percent compared to the
12 other size.

13 So, and larger than that, the numbers get
14 even smaller. As referenced earlier, not really so
15 much with steam but certainly with hot water, the
16 trend is modular units to add more. So I think you
17 will find the numbers in those larger classes are
18 certainly going to be fewer, and they definitely are
19 made to order.

20 If you bought your car made to order, it
21 would cost a lot more than what you go buy off the
22 lot.

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1 MR. BROOKMAN: Great. Thank you, Chuck.

2 That's helpful. Ashley.

3 MS. ARMSTRONG: This is Ashley. I'm going
4 to clarify one point, and that's not to say that
5 obviously, you know, those who are on the phone or if
6 ABMA is on the phone participating. We welcome
7 feedback on our pricing, especially for the larger
8 sizes. As you know, it is hard to get pricing for
9 built-to-order products. There is some complexity
10 there.

11 Our cost model does, within itself, within
12 the pricing that we've done, does take into account
13 the volume differences for capacity. So if we're
14 analyzing discrete capacities small and large, there
15 is a volume price difference there and that is built
16 into what you're seeing. It's not linear like you're
17 saying. So there is some benefit there.

18 Now what Adam's saying is the large unit
19 we looked at is three million, and maybe that price
20 point is different than a ten million unit. We would
21 welcome feedback on that.

22 We would welcome manufacturers of large

1 commercial, industrial boilers to work with us to
2 further refine our points. Happy to do that. Happy
3 to walk through that with them, and share with them
4 further about what we did. You too Harvey, if you
5 have data about a ten million --

6 Like I said, this is our first. We want
7 to put it out for comment. That's the whole purpose
8 of this.

9 MR. SACHS: I tried real hard to get the
10 ten million unit for my house, but despite its leaky
11 walls, I just couldn't take the whole wall out and I
12 didn't have head room.

13 MR. BROOKMAN: I want to go back to Chuck.
14 Can you -- you talked about how much linearity would
15 affect the larger sizes and the numbers. Is there
16 kind of a discrete break point there at the high end,
17 where a lot of these units -- can you characterize
18 what's going on with the market?

19 MR. WHITE: I would say 10 to 15 years
20 ago, it was probably a million BTU boiler would be a
21 very good candidate for going modular. The industry
22 didn't have a lot of product with large capacity and

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1 higher efficiency. But that has developed in the
2 last 10 to 15 years significantly.

3 So now there are products, high efficiency
4 products in the million BTU class that days ago were
5 not there. So it's a selling feature to a customer,
6 to tout the high efficiency abilities, and certainly
7 buying more than one multiple units adds labor and
8 adds product cost, but you can frequently demonstrate
9 the payback.

10 Kind of circling back a little bit to the
11 large steam boiler discussion there and your price
12 multiplier, your incremental difference, in large
13 boilers there's obviously a number of ways you can
14 manufacture them. But for years, it was square feet
15 of heating surface per horsepower, 500 square feet
16 per horsepower or I'm sorry, five square-foot, ten
17 square feet, what have you.

18 So higher efficiency means more square
19 feet of surface area, which adds pounds, pounds are
20 dollars. So my gut feeling is that 22,000 compared
21 to the baseline seems like a lot. But I really don't
22 have a way to quantify that.

1 MR. BROOKMAN: Okay. Harvey Sachs.

2 MR. SACHS: Harvey Sachs here. BSRIA [Building
3 Services Research and Information Association] has
4 every decade or so done cost comparisons, including
5 condensing boilers, various commercial sizes
6 internationally. It's one resource and another
7 resource that I would commend is the comments from
8 the transcripts of the negotiated rulemaking of 2013
9 on CCE, where a lot of the manufacturers of this
10 stuff were represented, and I suspect those
11 transcripts could be mined productively.

12 MR. BROOKMAN: Thank you. Frank Stanonik.

13 MR. STANONIK: No.

14 MR. BROOKMAN: No, not at this time?
15 Okay. Additional comments before we move on?

16 (No response.)

17 MR. BROOKMAN: All right.

18 MR. ANDHARE: So next we move on to doing
19 the analysis for condensing small gas mechanical
20 draft hot water and large gas mechanical draft hot
21 water equipment classes. The reason why we separated
22 these is one, is that we didn't have -- DOE did not

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1 have enough prices for the condensing boilers, and
2 the second is that the slope, the rate at which the
3 price increases for -- the incremental price
4 increases for the non-condensing levels is much lower
5 than what it is for the condensing levels.

6 So we took -- so for example, what we did
7 was we added an additional step in sort of
8 classifying it. Based on the companies or the
9 manufacturers, we added an additional step, where we
10 categorized it based on the materials used. So for
11 example, if we have A, B and C of the manufacturers
12 and 91, 92, 93 as the efficiency levels, we
13 classified it based on materials.

14 So materials, for example A and B
15 manufacturers produce boilers of Material 1, of type
16 Material 1, and the other one -- and C producers,
17 boilers of type Material 2. So we take the average
18 of the prices for Material 1 and similarly for
19 Material 2, and then we come down to the incremental
20 price.

21 So we subtract the price P2 minus P1, P3
22 minus P1, P4 minus P1, and take the average for each

1 and all efficiency levels. This is the way we get
2 down to the prices for -- incremental prices for the
3 condensing small gas mechanical draft hot water and
4 large gas mechanical draft water equipment classes.

5 Similarly, we also use another approach
6 for the small oil mechanical draft and large oil
7 mechanical draft hot water equipment classes. Here
8 we took the slope ratio that we obtained for the
9 small-sized boilers, the small-sized equipment class
10 of the gas-fired equipment class.

11 So suppose this is the price efficiency curve
12 for the small gas-fired mechanical draft hot water
13 equipment class, then we take the slope of the
14 condensing efficiency levels and the slope of the
15 non-condensing efficiency levels. We take the
16 average and calculate the slope for the condensing
17 efficiency levels using the equation.

18 So we have to use all these techniques
19 mainly because we do not have enough prices, and we
20 welcome prices from manufacturing contractors for the
21 NOPR stage of the analysis.

22 For natural draft equipment classes again,

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1 as I showed earlier, that only four percent of the
2 prices [we received] were for natural draft, and among the
3 prices we also received a price difference in converting a
4 boiler from a mechanical draft system to a natural
5 draft system.

6 So we have -- so we took that price
7 differential, which is based on the components that
8 are required for the mechanical draft assembly, like
9 the inducer, inducer fan assembly, the sensors,
10 etcetera, and subtracted it from the natural draft
11 assembly, that includes a vent damper and draft hood.

12 And we took the price differential and
13 subtracted it from the mechanical draft prices, and
14 this is the way we got the natural draft prices, and
15 then we calculated the incremental prices thereafter.

16 So these are the methodologies that we
17 used, and this slide and the next slide provides the
18 summary, just for future reference, and finally these
19 are the sample results that we obtained for our
20 analysis.

21 Here, I'm showing just two analysis, the
22 two equipment classes, that is the small gas-fired

1 mechanical draft hot water and the similar natural
2 draft hot water equipment class, and over here we can
3 see the charts. All this information is in the
4 Chapter 5 of the TSD, the engineering analysis chapter.
5 Now we have issues for comment.

6 DOE requests comment about the methodology
7 used to calculate incremental prices for increased
8 efficiency for each equipment class. DOE also
9 requests comment about the appropriateness of the
10 incremental prices reported as part of the
11 engineering analysis chapter, and also finally DOE
12 requests additional prices that are price-related
13 information, especially for natural draft boilers,
14 and that will further improve the analysis that you
15 already showed right now.

16 MR. BROOKMAN: Frank.

17 MR. STANONIK: It's interesting that for
18 whatever reasons, you weren't able to get enough
19 prices on natural draft boilers. Having said that,
20 obviously AHRI cannot and will not provide
21 information on specific prices, because we just don't
22 try to collect that information.

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1 But having seen the analysis here, we will
2 certainly discuss with our members whether we can
3 provide, give some -- perhaps can provide some
4 comments on the, let's say the percentage change as
5 you go up in each level of efficiency, whether it
6 makes sense or doesn't make sense.

7 That's about the closest we can come to
8 really addressing issues regarding prices, because as
9 a trade association, that's really something we try
10 to avoid addressing directly. But as I say, I'm a
11 little surprised you didn't get enough information.
12 So we'll see if we can at least indirectly help
13 resolve that issue.

14 MR. BROOKMAN: Do we have comments on the
15 methodology, the first item?

16 (No response.)

17 MR. BROOKMAN: No comments there. Joanna
18 Mauer, who is joining us via the web, asks a
19 question, and the question is "Did DOE try to look at
20 the incremental costs, as opposed to the incremental
21 prices?"

22 MR. ANDHARE: So we looked at the

1 manufacturer's selling prices. We did not look at
2 the manufacturer costs. So I think the engineering
3 analysis is primarily for the manufacturer selling
4 prices, what comes out of the manufacturer's
5 assembly.

6 MR. BROOKMAN: Okay, thank you. And
7 you'll note, if you look at the issue for comment
8 box, the final item, "DOE requests additional
9 price-related information." Frank, I know you're
10 limited. Are there other sources that DOE may not
11 have uncovered yet?

12 (No response.)

13 MR. BROOKMAN: At least not that we know
14 about. No? Harvey.

15 MR. SACHS: This is Harvey. I suggested
16 the BSRIA compendia is available for purchase.

17 MR. BROOKMAN: Okay.

18 MR. SACHS: I don't assure the quality,
19 but it is a resource.

20 MR. BROOKMAN: Okay, thank you. Yes
21 Frank?

22 MR. STANONIK: I went back and forth about

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1 asking this question, and honestly trying not to be,
2 I guess, snide about it. But I'm curious. I mean
3 the Federal government operates many buildings across
4 the United States, and purchases lots of things,
5 including heating systems and boilers.

6 And again, I have no appreciation, I'm
7 sure, for the complexities of this. But I'm just
8 curious as to what extent information might be
9 available to DOE, you know, in terms of boilers that
10 the Federal government purchases, whether it's an
11 Army base or whether it's a Federal building or
12 whatever.

13 I just wonder if there's, you know, if
14 there's some way that that information is available,
15 or it's just, you know, or we're dealing with such a
16 complex system? I mean no question, the Federal
17 government is huge, right. It's just, you know, kind
18 of out of the question but that data, you just
19 couldn't find it.

20 MR. BROOKMAN: Okay.

21 MR. ANDHARE: Well, I think the other
22 thing is that that will be a much lower subset of the

1 number of equipment class that we have, because we
2 need prices for each equipment class, and the
3 majority of the prices that we found were
4 concentrated in a few equipment class, but not so
5 much in the rest of them.

6 MR. STANONIK: That -- Frank Stanonik,
7 AHRI. I appreciate that. But not just this
8 rulemaking, many of the rulemakings, and again, it's
9 not an easy thing. But you know, the analysis always
10 runs up against the difficulty of getting, you know,
11 what I would say is a real world price.

12 In other words, what the ultimate
13 contractor or installer who actually is selling and
14 will be installing the product to the final customer,
15 you know, what the actual cost of that was. These
16 analyses and again, this is, you know, you do what
17 you can and we understand that.

18 But these analyses come from one end of it
19 only, and usually don't have much data. Okay, so
20 what was the, you know, real price somebody paid for
21 this thing?

22 MR. BROOKMAN: We have a few questions and

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1 comments from individuals on line. Jeff Kleiss
2 writes "Please clarify the size (input rate) of the
3 boilers for the plots on Slide 44."

4 MR. ANDHARE: So as you can see in the
5 table, the small size -- both of them are small-sized
6 equipment classes, and they range from 300 kBTU per
7 hour to 2,500 kBTU per hour, both of them.

8 MR. DARLINGTON: This is Adam. Both those
9 specific prices were obtained at 800,000 BTU per hour
10 representative --

11 MR. ANDHARE: Yeah. So yeah. The
12 equipment class is for the entire thing. But the
13 results are for the 800 kBTU product.

14 MR. BROOKMAN: Okay, thank you. That's
15 helpful, and Geoffrey Holly or Halley, pardon me, has
16 a comment. Geoffrey, you're next.

17 MR. HALLEY: Okay, thank you. This is
18 Geoff Halley with ABMA. I've been listening from the
19 start of the meeting, at several times actually, but
20 quite rightly Frank and all the people have talked
21 about the ABMA sizes of boiler, and I think they're
22 in a separate grouping really, from the smaller

1 sizes, below two and a half million input.

2 I really fail to see how you can take a
3 three million BTU boiler and extrapolate up to what
4 could be an 80 million BTU boiler. You know, the
5 largest hot water boilers that I'm aware of through
6 ABMA are around 80 million input. Forty million is
7 not uncommon, and probably the highest volume is
8 around 12-1/2 million input.

9 I just don't understand the logic in
10 taking such a small thing and hoping to extrapolate
11 it all the way out, and then that includes not only
12 the cost of testing, the cost of installation and so
13 on, but the cost of maintenance that's used.

14 I mean it looks to me as though they're
15 using something very small, maybe residential a
16 little bit more in estimated maintenance numbers, and
17 when you've got to climb the ladder to do some of
18 these maintenance checks, you know, there's no
19 relationship.

20 ABMA's members typically are all
21 modulating burners. You know, there's very few of
22 them that are less -- well, they start at 2-1/2

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1 million and go up basically, up to utility size. I
2 think there's got to be a cap at some point to make
3 it reasonable.

4 Another thing is in doing this engineering
5 analysis, where you look at the efficiency and the
6 life cycle cost paybacks, if you look at the
7 executive summary, they chart where they use a
8 standard lifetime of 24.8 years, irrespective of
9 efficiency.

10 Yet if you go to the background
11 information, if you like, in Table 8-F2.1, the
12 condensing boilers are listed as 10 to 50. It's in
13 the majority. There are -- I think there's one that
14 may say 20 years or something like that. But
15 certainly, there seems to be a different standard set
16 up between the executive summary and the data that
17 was available. I was wondering if somebody could
18 explain that to me.

19 MR. ANDHARE: So what was your --

20 MR. BROOKMAN: Geoff, you want to repeat
21 the question please?

22 MR. HALLEY: Yeah. The difference between

1 the executive summary average life time and what was
2 available in the background information that was in
3 Table 8-F2.1, which is also lifetime data.

4 It's a three-page chart or table, more or
5 less, and in that was several references to
6 commercial boiler lifetime if they're condensing
7 boilers of 10 to 15 years, and yet use a 24.8 year in
8 the executive summary. Is there some specific reason
9 for doing that? It doesn't make sense to me.

10 MR. BROOKMAN: Go ahead Adam.

11 MR. DARLINGTON: This is Adam, Geoff. So
12 the lifetime analyses that were done are part of the
13 LCC analysis, and we're actually going to get into
14 that, I guess, a little bit later on.

15 MR. HALLEY: Yes, sorry. I was having
16 trouble getting in on this conversation, so I
17 probably am loading more than I should have done
18 right now.

19 MR. BROOKMAN: Well Geoff, since you've
20 joined us, can you describe a more effective way to
21 characterize these size differences and the scaling
22 that --

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1 MR. HALLEY: Well, I think they've got to
2 be, you know. People have talked to the boiler count
3 in these different sizes. They are pretty well all
4 custom engineered. They may be standard heat
5 exchangers, but then they take that standard heat
6 exchanger and install it in something that's custom
7 engineered for each job installation basically.

8 And so that there's going to be
9 differences from one to the next, you know. The ABMA
10 stance has been, you know, put a cap on the thing at
11 two and a half million input. I don't know whether
12 that's feasible with what's been said by Ashley and
13 people like that.

14 But I see a lot of problems with testing,
15 the expensive testing and it's -- you know, it's not
16 just the installation. It's the fuel flows, and if
17 you're going to add part-load testing as well, then
18 you're going to, you know, jack up the price of
19 testing significantly, because of the huge fuel flows
20 that we have.

21 So there was a lot of things to consider
22 once you get beyond this, what I call small boilers,

1 which are, you know, probably less than five million.

2 MR. BROOKMAN: Geoff, maybe you --

3 MR. HALLEY: There's a lot of things that
4 have been missed in this analysis, that I don't know
5 whether it's because you didn't get the information
6 or you ignored it basically.

7 MR. BROOKMAN: Okay. Well maybe you,
8 Geoff, or someone else joining us, either online or
9 here in the room could, in your written comments,
10 describe a more suitable way to characterize these
11 size differences.

12 MR. HALLEY: Right, yeah.

13 MR. BROOKMAN: It would be very, very
14 helpful if you could do that. We also have --

15 MR. HALLEY: Well, I'll certainly do my
16 best, and I do intend to submit written comments.

17 MR. BROOKMAN: Okay, thank you. Joanna
18 Mauer asks "In general, looking at the incremental
19 prices, we tend to overestimate the actual costs to
20 improve efficiency. Was it not feasible to look at
21 the costs rather than the prices?"

22 MR. HALLEY: Well you know --

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1 MR. BROOKMAN: Geoff, I was going to -- I
2 directed that toward the presenter.

3 MR. HALLEY: Oh, okay.

4 MR. BROOKMAN: Yeah.

5 MR. ANDHARE: So --

6 MR. DARLINGTON: I can take this. This is
7 Adam. So yeah. I mean so our traditional, I guess,
8 methodology is to look at the manufacturing costs,
9 for the reasons Joanna states. Looking at the price
10 is a little bit more conservative, because it does
11 include some markups which, you know, can change at
12 higher efficiency levels and things like that.

13 But to Joanna's question, it was a little
14 bit less feasible here. Boilers are very large and
15 expensive, difficult to purchase, tear down,
16 difficult to handle. So we went with the pricing
17 methodology. It was consistent with the methodology
18 that was used in the last boiler rulemaking, which
19 was also publicly vetted at that time.

20 No stakeholders really raised concern with
21 doing a pricing methodology then. So it was kind of
22 a previously vetted publicly vetted methodology, and

1 it was also a lot more feasible, in terms of, you
2 know, just gathering price information and coming up
3 with an average price rather than buying a bunch of
4 really big and expensive boilers.

5 MR. BROOKMAN: Okay, okay.

6 MR. DARLINGTON: So that was sort of the
7 primary driver.

8 MR. BROOKMAN: I think that the presenters have
9 done a good job of describing the limitations, the
10 difficulty in trying to fully characterize these huge
11 differences in size and price. Okay. Final comments
12 on this section before we move on, because we're just
13 about due for a break.

14 So I think at this -- this would be an
15 appropriate time for a break.

16 MR. RABA: Yes.

17 MR. BROOKMAN: It's 10:30. Let's take a
18 15-minute break. Those of you that are familiar with
19 the procedures here at the Department of Energy,
20 please wear your badge visible. The restrooms are on
21 both ends of the hall. There's a coffee shop down on
22 the ground floor, just about directly underneath us.

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1 Go to the elevators and go there and we'll resume at
2 10:45. We've got a good start on the day, and we'll
3 proceed at 10:45 right here.

4 (Whereupon, a short recess was taken.)

5 MR. BROOKMAN: Let's resume. Please take
6 your seats. We're going to pick up where we left
7 off, and Markups, Energy Use Characterization, LCC
8 and Payback Period Analysis.

9 Markups, Energy Use Characterization and LCC

10 MS. SINGLA: Okay. So my name is Rupam
11 Singla from Lawrence Berkeley National Lab.

12 MR. BROOKMAN: Get close to the
13 microphone.

14 MS. SINGLA: And today I'll be talking
15 about Markups, Energy Use Characterization and the
16 Life Cycle Cost Analysis. Later today, I will also
17 be presenting the Shipments and the National Impact
18 Analysis.

19 So the next step in the analysis is to
20 determine the markups, in order to determine the
21 consumer price, and we also characterized energy use.
22 We used those both as primary inputs into the life

1 cycle cost analysis. So DOE determined the cost to
2 the consumer of baseline equipment and the cost of
3 more efficient units under new energy conservation
4 standards.

5 DOE calculates such costs based on the
6 engineering analysis cost appropriate markups.
7 Markups are used in DOE's analysis to convert the
8 manufacturer's selling price to the consumer price.
9 The manufacturer's selling price is what Rohit talked
10 about earlier in the engineering analysis.

11 For wholesalers and contractors, DOE
12 developed a baseline markup and an incremental
13 markup. Baseline markups are applied to the baseline
14 manufacturer's selling price. They relate baseline
15 efficiency equipment manufacturer's selling price to
16 direct business costs.

17 Incremental markups are applied to the
18 incremental manufacturer's selling price.
19 Incremental markups relate to incremental change in
20 consumer price to the incremental change in
21 manufacturer's selling price under new energy
22 conservation standards. We make the distinction

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1 between baseline and incremental markups, in order to
2 account for cost, fixed costs that do not scale up,
3 such overhead and labor.

4 Both baseline and incremental markups are
5 calculated for each point in the distribution
6 channel. We'll talk more about distribution channels
7 in just a few moments. Markups were developed for
8 the following market participants: manufacturer,
9 wholesaler, mechanical contractor and general
10 contractor, and sales tax and markups were calculated
11 separately for each geographic region in the
12 analysis.

13 So this table lists the data sources for
14 the markups analysis. The distribution channels is
15 how the equipment moves from the manufacturer to the
16 purchaser. We developed distribution channels
17 separately for replacement and new construction
18 markets, and we developed these based on stakeholder
19 input.

20 The manufacturer markup was determined in
21 the engineering analysis, and is based on the U.S.
22 Security and Exchange Commission 10(k) reports from

1 publicly owned commercial boiler manufacturing
2 companies. The wholesaler markup is based on firm
3 income statements from the Heating, Air Conditioning,
4 Refrigeration and Distributors International or HARDI
5 2013 Profit Report.

6 The mechanical contractor markup is based
7 on the Air Conditioning Contractors of America or the
8 ACCA 2005 Financial Analysis Report, and the Plumbing
9 and HVAC Contractor sector from the 2007 Economic
10 Census. The general contractor markup is based on
11 the Commercial Building Construction sector in the
12 2007 Economic Census. Sales tax is based on the 2014
13 Sales Tax Clearinghouse data.

14 So this slide presents the market
15 participants for each distribution channel
16 considered. So we considered separate distribution
17 channels for replacement and new construction market.
18 DOE considers an additional distribution channel
19 where the consumer buys directly from the
20 manufacturer through a national account, and you can
21 see the national account is present in both the
22 replacement and new construction markets.

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1 This table shows the results of the
2 markups analysis. For several of the product
3 classes, we show the average baseline and average
4 incremental markups. The markups are actually
5 distribution. This is just the average from the
6 results. So DOE requests several -- DOE has several
7 requests for comments related to the markups.

8 So DOE seeks comments about whether the
9 considered distribution channels are appropriate for
10 commercial boilers. DOE seeks comments about the
11 percentage of equipment being distributed through the
12 different distribution channels, and whether the
13 share of equipment through each channel varies, based
14 on equipment costs or equipment capacity.

15 DOE also requests comments about its
16 proposed approach to developing estimates of future
17 commercial package boiler retail prices. Finally,
18 DOE requests recent data to establish the markups in
19 commercial consumer price for the parties involved,
20 for the distribution of the equipment.

21 MR. BROOKMAN: Chuck.

22 MR. WHITE: This is Chuck White with PHCC.

1 So a question relating to sales tax. Especially in
2 the larger products, some of the products in some
3 products would be tax-exempt if they're for
4 manufacturing purposes. Do you have any way to
5 recognize that, or is that something that's skewing
6 the data?

7 MS. SINGLA: We did not have any data on
8 that, and it was not considered. But we would
9 encourage you to submit a comment, and we can
10 consider it in the NOPR phase.

11 MR. BROOKMAN: Do you know approximately
12 how -- is it many states that offer an exemption for
13 large manufacturers?

14 MR. WHITE: I don't know nationwide. I
15 live in Indiana. I know in Indiana it does, I know
16 in Michigan it does. Those are the two states I've
17 had that most previous work experience in. So that's
18 certainly something to be looked into.

19 Second question, when you talked about
20 national accounts -- I rescind my question. I've
21 answered it.

22 MR. BROOKMAN: Okay, thank you. Yes

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1 Frank.

2 MR. STANONIK: Frank Stanonik, AHRI. I
3 guess -- but I do have a question about national
4 accounts. What exactly are we talking about? I'm
5 not sure I understand what that is.

6 MS. SINGLA: Alex, would you mind stepping
7 to the microphone.

8 MR. BROOKMAN: The question is what --
9 Frank's asking what national accounts is, what it
10 represents in the distribution channel.

11 MR. LEKOV: Our understanding is that for
12 some larger part is the manufacturer have a direct
13 way of basically allowing the equipment to be
14 purchased and we call this a national account. It's
15 small part of the market, and it's explained in the
16 technical support document.

17 MR. BROOKMAN: Okay. I'm looking at these
18 comment boxes here. Additional thoughts on the
19 distribution channels, percentage of equipment being
20 distributed through different distribution channels,
21 and whether the share of equipment through each
22 channel varies based on equipment class or equipment

1 capacity. What about that one?

2 MR. WHITE: This is Chuck White. I have a
3 question then. Would this still be pegged to our
4 800,000 and three million 800 MBH and 3,000 MBH
5 products, or are we -- that we talked about in
6 engineering. The large was typically based on the
7 three million. The small was --

8 MS. SINGLA: Right. So we considered the
9 same representative capacities, yes.

10 MR. WHITE: Okay, because what makes me
11 wonder is up to a threshold, not necessarily
12 guaranteed, but commercial boilers, probably up to
13 that three million maybe four million, probably have
14 a lot of wholesaler presence. But anything in the
15 large over four million, the ten million we talked
16 about, the 25 million, is not going to come through a
17 wholesaler. It's going to come most likely through a
18 manufacturer's representative.

19 MS. SINGLA: So in our analysis, we
20 actually did assume that the smaller boilers go
21 through a wholesaler, and the larger boilers commonly
22 go through a manufacturer's representative.

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1 MR. WHITE: Okay.

2 MR. BROOKMAN: Thank you. Do we have any new
3 information in response to Issue No. 7, Proposed
4 Approach to Developing Estimates for Future
5 Commercial Packaged Boiler Retail Prices? Anything
6 new on that horizon? No, okay. Chuck.

7 MR. WHITE: Well, this is Chuck White,
8 PHCC. I guess I would need a little more definition
9 about what's retail. In my world, I would think that
10 the contractor's selling price would be the retail
11 price that goes to the end user. But --

12 MS. SINGLA: Yes, so we are considering
13 the retail prices, the consumer price.

14 MR. WHITE: Okay.

15 MR. BROOKMAN: So that would include
16 installation?

17 MS. SINGLA: Not including installation.

18 MR. BROOKMAN: Not include installation.
19 Okay. Any new data available in any of this? As
20 usual, the Department is searching. Okay. Robert
21 Glass has a comment. Robert, we will unmute you and
22 hopefully we can hear you in the room.

1 MR. GLASS: Hello, can you hear me?

2 MR. BROOKMAN: Yes, we can. You sound
3 good.

4 MR. GLASS: Okay. Yeah, the comment I had
5 was basically that the -- really the wholesaler does
6 not really apply to commercial boilers, even in the
7 smaller sizes, because there are so many permutations
8 and combinations of controls and requirements between
9 low water cutoffs, high and low gas pressure
10 switches, manual reset versus auto reset high limits.

11 There's so many different things that
12 every particular installation or engineer, or
13 state has requirements for, that those are primarily
14 done through a manufacturer's representative, where
15 they buy -- and many of those are buy-sell rep, where
16 they actually go ahead and purchase the boilers from
17 the manufacturer, and then they sell to the
18 contractor engineer end user, at some price that's
19 reflective of the total work that they have done on
20 the project.

21 They are not necessarily just supplying
22 the boiler, but maybe providing many pieces of

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1 equipment and expertise in regards to the
2 installation and sizing of that equipment. So that
3 the price that is charged is not necessarily just the
4 price of the equipment. Also, the work that goes
5 into getting that and any additional time and effort
6 in that process.

7 MR. BROOKMAN: Okay, thank you. That's
8 helpful. Frank Myers also has a comment. Frank, we
9 will unmute your phone. Please proceed.

10 MR. MYERS: Yes, can you hear me?

11 MR. BROOKMAN: Yes, you sound good.

12 MR. MYERS: Yes. I was just noting in a
13 previous slide, if I understood it correctly, you
14 were saying that the markup was that represented by
15 publicly traded companies, and if that's the case,
16 then that would not be reflective of the vast number
17 of smaller manufacturers, because the publicly traded
18 companies are generally higher volume and therefore
19 gain substantial economies of scale from the higher
20 volume.

21 So I would cautious about using that
22 across the board to reflect the markup for smaller

1 manufacturers.

2 MR. BROOKMAN: And Frank, if you have any
3 information you could supply to the Department in
4 writing, even under a non-disclosure agreement with
5 Navigant, then that would be very helpful.

6 MR. MYERS: All right, thank you.

7 MR. BROOKMAN: Thank you. Okay. So
8 additional comments. You see the comment boxes
9 listed there. Anything additional before I move on?

10 (No response.)

11 MR. BROOKMAN: Okay.

12 MS. SINGLA: All right. So we just
13 finished the determination of consumer price. Now
14 we're going to talk about energy use
15 characterization. So the annual energy consumption
16 of a boiler was calculated in order to assess the
17 energy savings as a result of increases in boiler
18 efficiency.

19 The annual energy consumption is the site
20 energy use of the boiler. The annual energy
21 consumption is the sum of the space heating fill
22 usage, the water heating fill usage and any

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1 electrical usage from auxiliary components. We'll go
2 through each of these components in detail.

3 So the energy use -- our energy use
4 analysis is based on boilers installed in real
5 buildings. The Energy Information Administration or
6 the EIA has a sample of commercial buildings, called
7 CBECS, and a sample of residential buildings called
8 RECS. These two building surveys serve as the
9 representative sample for our energy analysis.

10 In order to be in an energy analysis at
11 all, a building and other survey must satisfy three
12 criteria. The first is that it must have a boiler,
13 and the boiler must be used for either a main or
14 secondary source of heating in the building.

15 The second is that the heating fuel of the
16 boiler must either be natural gas or fuel oil, and
17 the third is that the reported space heating energy
18 usage of the building must be greater than zero. So
19 if a building in either our CBEC or REC survey
20 satisfies all three of these criteria, then it goes
21 into the flow chart.

22 The first thing that we look at is the age

1 of the building. So if the building is old, then
2 there's a chance that the boiler installed in the
3 building will be a steam boiler. Otherwise, we
4 assume that the boiler is hot water.

5 So the top portion of the chart is for
6 steam boilers, and the lower portion of the chart is
7 for hot water boilers. It is the same methodology
8 for both heating mediums.

9 So once we consider the heating medium,
10 the next thing we look at is the boiler fuel type.
11 Whether the boiler is gas or oil comes directly from
12 the building survey, from CBEC surveys. Next, we
13 determine the draft type. So we assume a split
14 between mechanical and natural draft, based on ratios
15 in the AHRI database, the AHRI models directory.

16 Beyond that, we determine the -- based on
17 the input capacity of the boiler, we either put the
18 building into the large boiler equipment class or the
19 small boiler equipment class.

20 This flow chart gives an overview of how
21 the space heating fuel consumption is determined. So
22 we start with the energy use from the building sample

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1 that we just talked about. We assume an efficiency
2 for the existing boiler in that building.

3 We do this based on the year that the
4 building was built. So we studied the AHRI models
5 databases from 2007 to 2014, and we determined the
6 average efficiency by product class for each year
7 from 2007 to 2014. We looked at the trend in the
8 average efficiency, and we projected that backwards
9 to determine what the average efficiency has been
10 over time.

11 So then, based on the year that the
12 building was built, we were able to determine or able
13 to assume an efficiency of the existing boiler. We
14 also calculate some adjustment factors, or we apply
15 some adjustment factors based on EIA data.

16 One factor that we apply is to adjust for
17 the building shell. This is to account for the fact
18 that a building built in the year 2019 will have a
19 better shell efficiency, that is better insulation
20 and better windows than a currently existing
21 building.

22 We also adjust for heating degree days.

1 So we take the heating degree days in 2003, which is
2 the year of the CBEC survey, and we normalize it to a
3 ten-year average heating degree days. This is to
4 make the fuel usage more representative over a longer
5 period of time.

6 So we combine the energy use from the CBEC
7 sample with the existing equipment efficiency and the
8 adjustment factors, and we get the building heating
9 load. Then for each considered efficiency level,
10 that is the proposed rated efficiency, we apply some
11 adjustments to it, which we'll talk about a little
12 bit later.

13 So we combine then the adjusted thermal
14 efficiency, the building heating load and the input
15 capacity of the boiler, in order to determine the
16 full-load burner operating hours. We then
17 combine the full-load burner thermal operating hours
18 with the input capacity, and we get the space heating
19 fuel usage.

20 So these are the equations in the space
21 heating fuel analysis. This is everything I just
22 went over. These are just the equations that we used.

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1 The thermal efficiency is the basis for our energy
2 use analysis. There are four equipment classes that
3 are by combustion efficiency rather than thermal
4 efficiency.

5 For these four equipment classes, we
6 studied the AHRI models directory and determined the
7 relationship between combustion and thermal
8 efficiency. So based on this relationship, for each
9 combustion efficiency we assumed a thermal
10 efficiency.

11 The efficiency at the considered
12 efficiency level is the rate of thermal efficiency.
13 The rate of thermal efficiency is what is determined
14 for the test procedure. The test procedure occurs in
15 a lab at 100 percent boiler input capacity, with a
16 boiler return water temperature anywhere between 35
17 and 80 degrees Fahrenheit, and a boiler supply water
18 temperature of 180 degrees.

19 The actual thermal efficiency experienced
20 in the field, experienced in actual boiler
21 installations varies with climate, with whether the
22 boiler modulates to meet low loads or cycles, and

1 with the system water temperature heats.

2 So boiler performance at different return
3 water temperatures and different loading conditions
4 was assessed based on manufacturer literature. In
5 this analysis, the annual average field thermal
6 efficiency for each climate zone in each boiler type,
7 that is condensing versus non-condensing, was
8 calculated. The average field thermal efficiency
9 accounts for all of these factors.

10 MR. WHITE: This is Chuck White. Could
11 you restate those temperatures of the return water
12 and the leaving water?

13 MS. SINGLA: Yes. The return water
14 temperature has to be between 35 and 80 degrees, and
15 the leading water temperature is 180.

16 MR. WHITE: Thank you.

17 MS. SINGLA: So as I mentioned before, the
18 analysis also accounts for fuel consumed for water
19 heating. So we looked at the building surveys, CBECS
20 and RECS, and determined buildings that were part of
21 the same fuel type for both space heating and water
22 heating.

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1 We assume that in half of those buildings,
2 the boiler was used for water heating in addition to
3 space heating. We determined the water heating fuel
4 use as a function of the water heating load, and in
5 adjusted thermal efficiency.

6 We determined the water heating load as a
7 function of the fuel consumption from the building
8 survey, and an adjusted existing thermal efficiency.

9 MR. BROOKMAN: We have a comment from
10 Robert Glass, or actually perhaps a question, which
11 is "You note the percentage of hot water versus steam
12 on Slide 54. What about mechanical draft versus
13 natural draft for both steam and hot water boilers?
14 What percentages does DOE estimate? This refers to
15 space-heating boilers. Does this rulemaking cover
16 process boilers that are not providing space
17 heating?"

18 MS. SINGLA: So to answer the second
19 question first, this rulemaking does not cover
20 process boilers that are not used for space heating.
21 All these boilers must be used for space heating.
22 The first question is the split between mechanical

1 and natural draft is different for whether the boiler
2 is oil or gas and whether it's steam or hot water,
3 and those ratios are based on the AHRI models
4 directory.

5 MR. BROOKMAN: Okay, thank you.

6 MS. SINGLA: So as I mentioned earlier,
7 the analysis also accounts for electricity
8 consumption of the boiler. DOE calculates
9 electricity consumption for the circulating pump,
10 draft inducer in the case of mechanical draft
11 equipment, and the igniter.

12 DOE calculates electricity use for all of
13 these components whenever the boiler burner is on,
14 either for space heating or water heating. For all
15 hours when the boiler burner is not on, DOE accounts
16 for standby power. Standby power is assumed for all
17 mechanical draft equipment, and not for natural draft
18 equipment. DOE also considers the electricity use of
19 a condensate pump for some condensing boilers.

20 So this chart shows the results of the
21 energy use analysis. This is four of the equipment
22 classes, each efficiency level. We have the annual

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1 average fuel use and the annual average electricity
2 use.

3 DOE seeks comments on a number of issues
4 related to energy use characterization. The first is
5 DOE seeks data on representative annual profiles of
6 return water temperature, supply water temperature
7 and boiler percent loading. DOE seeks data on what
8 return water temperature boilers are tested at, under
9 the test conditions prescribed by the DOE test
10 procedure.

11 DOE seeks input on data sources that it
12 can use to characterize the variability and the
13 annual energy consumption for commercial boilers.
14 DOE is particularly interested in field monitoring
15 studies and data.

16 MR. BROOKMAN: Let's pause with those, to
17 try and get comment on 9, 10 and 11. Do we have
18 anything here?

19 (No response.)

20 MR. BROOKMAN: No, okay.

21 MS. SINGLA: DOE requests data about
22 typical boiler-sizing practices. How often are

1 multiple boilers installed instead of single boiler,
2 to meet the building heating load. How are the
3 number of boilers determined for a particular type of
4 installation?

5 DOE seeks input about how boilers are
6 controlled, particularly in multiple boiler
7 installations. DOE states historical
8 shipment-weighted commercial packaged boiler
9 efficiency data and shipments data by efficiency
10 bins.

11 DOE is primarily interested in data during
12 the last ten years to capture the impact of the most
13 current technologies on the boiler market.

14 MR. BROOKMAN: What about typical boiler-
15 sizing practices? We kind of touched on this
16 already. Harvey.

17 MR. SACHS: This is Harvey Sachs. It
18 seems to me, without any particular expertise in the
19 area, that boiler sizing has two dimensions, and the
20 dimension that's of concern is how the field
21 oversizing of capacity affects efficiency in the
22 field application, and what the oversizing practices

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1 are in the field.

2 I don't think we've seen much on that. In
3 the old days, of course, a way over-sized one would
4 have way over-sized standby losses. We hope that's
5 under somewhat better control now, but nobody ever
6 called his contractor to complain that his boiler was
7 too large. So we expect substantial oversizing for
8 the actual peak draws that we would expect in the
9 facility.

10 MR. BROOKMAN: Okay, thank you. Frank.

11 MR. STANONIK: A slightly different point,
12 and we certainly will try and see if we can provide
13 some information here. But I think that one of the
14 things, and maybe it's one that -- actually, I guess,
15 relates to maybe 13 also, but this goes back some
16 time.

17 But I was really surprised to learn that
18 for certain building types, it is not at all unusual
19 for the building to have a backup boiler, which at
20 least historically was really mostly there if in case
21 something would happen with the first boiler and that
22 particular building, as an example let's say it was a

1 large hotel, could not, you know, could not accept
2 that they didn't have heat.

3 So they would invest actually in having a
4 backup boiler, which again things have evolved here,
5 I think. But in the past, it was really there just
6 as a backup. So I think there is a really change
7 here that buildings do have multiple boilers. I
8 think more buildings, the progress, if you will, is
9 that now you have multiple boilers that are actually,
10 let's say, commonly controlled.

11 So in fact they're staging those boilers
12 or else alternating which one is let's say the master
13 boiler or whatever. But I think you still have that
14 situation where you have again, for certain building
15 types, there's a secondary boiler that is not
16 expected to do much except be there in case the first
17 boiler needs repair or fails.

18 I guess I would say you can't ignore it,
19 you know. Somebody has paid for that second boiler,
20 and isn't going to operate it very much. So it's
21 kind of -- you know again, to me that's hard to
22 understand. But I think you just need to look at the

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1 kind of building where that might be the requirement.
2 So in any case, I mean we'll -- we're going to try
3 and see if we can give you a better sense of how much
4 that goes on nowadays, because I think it does matter
5 when you're looking at the energy use of the boiler.

6 And then as -- I'll just jump to 14. We
7 certainly have had some preliminary discussions with
8 our members, and at this point I think we will be
9 able to give you some data of that nature. I'm not
10 sure of exactly the business that DOE would like, but
11 I think we can help with some of that information.

12 MR. BROOKMAN: Frank, can you or Chuck,
13 can you address Issue 13, how boilers are controlled
14 in these multiple boiler --

15 MR. SACHS: Can we get Chuck on the
16 oversizing first.

17 MR. WHITE: I'll weigh in on all of it for
18 you Harvey, just to be nice. This is Chuck White.
19 Starting with 12, the sizing practices. My favorite
20 phrase is it depends. Once upon a time you stood
21 across the street and held up your hand, and however
22 many fingers covered the house, that's how many

1 sections you needed. Two, three, I can't see the
2 house anymore. I need a four-section boiler. Those
3 things are pretty much long gone.

4 MR. SACHS: That's a precise measurement
5 there.

6 MR. WHITE: Yeah, yeah. But I think most
7 contractors in the retrofit world are doing one of
8 two things. Most are doing heat loss calculations.
9 So you're determining the load of the house, but you
10 also have a concept called connected load, and I
11 don't have to lecture the room probably, but boilers
12 aren't furnaces.

13 Boilers and hot water and steam systems,
14 particularly steam systems, are a different animal in
15 how they operate and perform. So if we don't have
16 enough heat to meet the connected load, particularly
17 in steam, if we don't have the ability to fill the
18 system with steam, it's not going to heat
19 effectively.

20 So in retrofits especially, it gets to
21 looking into what the system is. Maybe I think I
22 have an 80,000 BTU heat load on the house. But if I

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1 have 150,000 BTUs worth of radiators installed, it
2 may not heat properly. There's a lot of what ifs
3 connected with, particularly renovations and
4 retrofits in old systems.

5 In new installations, the engineering work
6 and the layout is certainly doable. But it's also
7 very important if you're going to use high efficiency
8 products, which we touched on with the return water
9 temperature discussion. If you want to be high
10 efficiency, you need lower return temperatures
11 generally speaking, to be operating in that effective
12 part of the curve.

13 So it's a comprehensive sizing problem,
14 and whether it's an engineer that does it or a
15 contractor that does it, how that happens, it takes
16 some skill and some thought and some ingenuity.
17 There are certainly people out there that, you know,
18 retrofit situation walk in and you've got a size ten
19 and you need a size ten. If you've got a size 12,
20 you need a size 12, whatever that might be.

21 But most contractors are looking at the
22 system as a whole. Particularly if you're moving to

1 high efficiency, it's very important to consider
2 those factors. Not to say there isn't oversizing
3 going on, and we can refine our mathematics to
4 multiple decimal points. But at the end of the day,
5 I'm going through a catalogue that has fixed sizes in
6 certain increments, and I'm going to pick something
7 that takes care of the load.

8 It's very nice to have modulating products
9 that can come down, fire-down to the load you need.
10 But that's not always the case. Moving to 13,
11 multiple boiler controls, there's a variety of ways
12 you can do that.

13 There's after-market products that you can
14 put in that will connect to existing multiple
15 boilers, give you staging and functions based on
16 outdoor temperature, you know, how many run, how much
17 run time, adjust the water temperature. There's lots
18 of products that will do that.

19 Many of the new products, new boiler
20 products communicate with each other. So you can use
21 multiple boilers and just connect them together with
22 a cable, and they will talk to each other and decide

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1 who ran the most and who's at 100 percent, who needs
2 to be 50 percent and make these adjustments.

3 So there's a variety of ways you can
4 control multiple boiler installations. There's not a
5 one-size-fits-all answer here, unfortunately. Was
6 that helpful?

7 MR. BROOKMAN: Okay, thank you. Any
8 additional thoughts on these? Frank.

9 MR. STANONIK: Frank Stanonik, AHRI. Just
10 picking up on what Chuck just said there, I mean
11 again, I'm not sure this is doable or that even our
12 membership can, you know, can really help with this.

13 But on 13, I think, you know, it would be,
14 if we could find the information, it would be useful
15 to know today how many commercial boiler
16 installations actually include in the installation
17 essentially a system control panel, if you will, that
18 adds all this sophistication to controlling the
19 boilers and the system.

20 Because yeah, I mean I know our members
21 are out there selling those control packages, if you
22 will, as well as others as an after market, and it

1 certainly has, I think grown in its use.

2 MR. WHITE: Well, this is Chuck White
3 again. There is a large industry of building
4 management control that's set aside from the
5 contractor. The contractor may install new boilers,
6 do all the piping, do all of that. But then a
7 control contractor would be a separate person making
8 those connections, integrating it into a building
9 management program.

10 So there's from very simple to extremely
11 complex ways of doing this, and it's really a matter
12 of who's the customer and what are their needs, and
13 what are their abilities to underwrite this
14 undertaking.

15 MR. BROOKMAN: Okay, thank you. I guess
16 we don't have any historical shipment-weighted
17 commercial boiler efficiency data or shipment data by
18 efficiency bins at this point? Are you going to work
19 on that one, Frank?

20 MR. STANONIK: Yes.

21 MR. BROOKMAN: Okay, okay.

22 MS. SINGLA: A few additional comments.

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1 DOE requests --

2 MR. BROOKMAN: Harvey has a comment.

3 Sorry.

4 MR. SACHS: This Harvey. Just thinking
5 back on the conversation the last 10 or 15 minutes,
6 and the overlap in teasing outs between redundancy
7 and modularity, because I think we're seeing both in
8 the market, of people who need 100 percent backup and
9 are concerned about having a single large boiler,
10 without having a second large boiler, I've also
11 informally and anecdotally heard about lots of other
12 approaches.

13 One of them is to have ten small boilers
14 that together have 130 percent or 120 percent of the
15 peak load, so that if any one of them goes down,
16 you're still not in trouble.

17 Those can be, in some systems, dispatched
18 as a single unit with a single interface to BAS. So
19 it's getting to be a very complex world, and I do not
20 have any idea of how this is affecting shipments of
21 any particular capacity unit.

22 But I think it's important to understand

1 the market. In the redundant case that was brought
2 up very early, one could make a strong case for a
3 very inexpensive minimum efficiency secondary boiler
4 that's just never getting used. It's only there is
5 an insurance policy, and on the other hand, the
6 public policy implications of going down that path
7 and controlling it are just almost impossible to
8 manage.

9 So I think we need to be very careful with
10 understanding applications in this area.

11 MR. BROOKMAN: Chuck.

12 MR. WHITE: This is Chuck White again. I
13 meant to comment on that aspect as well. But
14 redundant boilers, certainly they're being put in,
15 but not as much as previously. The modular aspect,
16 you're exactly right Harvey. If I don't really need
17 120 or 130 percent, if I put in four units that would
18 give me 100 percent, if one goes down I'm at 75 and
19 the time frame that you are design load is very, very
20 small.

21 So that 75 percent capacity will probably
22 carry 95 percent of the time, and in the current

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1 economic climate and conditions, people are very
2 attuned to not spending an additional 40-50 percent
3 of the heating project to have that redundancy, when
4 we could do it and be safe enough.

5 And regarding the buying one that's a low
6 efficiency product, that's probably not going to
7 happen. Most -- if you do buy redundant, most people
8 set up a schedule to rotate them, so that you don't
9 have one sitting there hoping it works some day, that
10 we're routinely switching them.

11 So if something's going to fail on one of
12 them, we'll find out and be able to fix it. It does
13 happen in retrofit-type operations. There's two
14 boilers there now. This one still works. We'll save
15 it as the backup, and then put in other products,
16 newer, higher efficient products.

17 But what typically I've seen is when
18 people do that, they like their new stuff so much
19 better, they don't rotate the other, and it sits.
20 You might as well tear it out when you started. But
21 the modular aspect really makes a big difference to
22 people, that I can give you 50, you know, steps of

1 20, 40 percent, to give you coverage for the majority
2 of the time.

3 MR. BROOKMAN: Okay, thank you.

4 MR. SACHS: This is Harvey again, and I
5 think it would be worthwhile for the Department, as
6 it's investigating the market, to get in touch with
7 the relevant ASHRAE technical committee and see what
8 design practices are (a), recommended and (b) what,
9 at least anecdotally, these people feel are most
10 commonly used in these larger systems. It may well
11 be that PHCC members have some good input onto that
12 as well.

13 MR. BROOKMAN: Okay, thank you. Frank.

14 MR. STANONIK: Frank Stanonik, AHRI. I've
15 got a question, and again just because I've lost
16 track of it. You're still using 2003 CBECS data.
17 Isn't there something going on to develop an updated
18 database for CBECS, and will it be in time for this
19 analysis or too late?

20 MS. SINGLA: Yeah. So there's a CBECS
21 2012 that hasn't been fully published yet. Hopefully
22 by the time the NOPR phase comes along, it will be.

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1 But I don't believe we have a publication date for
2 that.

3 MR. STANONIK: Okay. So let's say that --

4 MS. SINGLA: So 2003 is the latest
5 version.

6 MR. STANONIK: Right. So let's say the
7 2012 final appears magically in a few months here.
8 Will DOE be updating the analysis to use the new
9 data?

10 MS. SINGLA: As long as it comes in time,
11 then yes.

12 MR. STANONIK: Okay.

13 MR. BROOKMAN: Okay. Let's go to 15 and
14 16.

15 MS. SINGLA: All right. So DOE requests
16 input about electricity use by commercial boilers.
17 That is in addition to the fuel energy use, and that
18 should be included in the energy use analysis. DOE
19 seeks input what fractions of hot water commercial
20 packaged boilers are used for both space heating and
21 water heating.

22 MR. BROOKMAN: While you're considering

1 those requests for comment, Robert Glass has a
2 comment. Robert, we will unmute your phone. Please
3 go ahead.

4 MR. GLASS: Hello?

5 MR. BROOKMAN: Yes, you're on.

6 MR. GLASS: Okay. Yeah. The first
7 comment, I think, had to do with a note that Harvey
8 Sachs had mentioned a little bit ago, talking about
9 the oversizing, and I think the one thing we need to
10 also take into consideration is that the sizing is
11 done based on the design conditions, and as a result
12 it could seem like that you have oversized systems,
13 unless you actually get to those design conditions.
14 I think that was mentioned at the end there.

15 And then another comment having to do with
16 the types of applications that would have redundant
17 equipment, and they were noted. I mean hospitals,
18 hotels, prisons, colleges. They all provide
19 redundant boilers that Frank Stanonik had talked
20 about. However, it may not be a 100 percent
21 redundancy, but enough to provide a limp-along
22 condition to be able to provide heat until issues

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1 could get resolved in other boilers.

2 So there is redundancy that is there. It
3 is very frequently used, but it is not necessarily a
4 100 percent redundancy.

5 MR. BROOKMAN: Okay, thank you. Geoff
6 Halley also has a comment. Geoff, we'll unmute you.
7 Go right ahead. Nothing yet.

8 (Pause.)

9 MR. BROOKMAN: Is he unmuted? Yes.
10 Geoff, we think we've unmuted you. Try it. Hmmm.
11 It's not working. Okay. Let's look again at Issue
12 15 and 16, electricity use by commercial boilers in
13 addition, and what fractions of hot water commercial
14 packaged boilers are used for both space heating and
15 water heating. Frank.

16 MR. STANONIK: Frank Stanonik, AHRI. I
17 feel bad about this one, because I could have just
18 looked it up before I got here or last week. But I
19 think certainly when you're looking at the electrical
20 consumption and you noted that you do include the
21 circulating pump, the energy used by the circulating
22 pump, I think you absolutely need to look at what

1 again ASHRAE 90.1 specifies today for the
2 requirements for pumps used for hydronic heating
3 systems.

4 Because even though -- even though those,
5 at least mostly in theory this applies to new
6 buildings, those ASHRAE requirements, when you get
7 into things like system controls and what have you,
8 become more widespread, whether it's a new
9 installation or a changeout, if you will.

10 But I think I can dig that up and just,
11 you know, provide that in our comments. But I think
12 there has been significant progress in requiring or
13 specifying a more efficient mode of pumps for the
14 circulating pump.

15 MR. BROOKMAN: What about fractions for
16 hot water space heating and water heating?

17 MR. STANONIK: Frank Stanonik, AHRI. I
18 think we've answered that one in the framework. We
19 don't have any idea what that is.

20 MR. BROOKMAN: Chuck.

21 MR. WHITE: This is Chuck White. I don't
22 really have any good answer for 16, but I can

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1 certainly ask and see if we have any information
2 available through our members.

3 But picking up on what Frank said about
4 the pumps, does DOE consider -- are we talking about
5 the system pump or the boiler pump or both,
6 particularly high efficiency boilers like to use
7 primary/secondary arrangements.

8 So you have a small, smaller pump for the
9 boiler, and it circulates the water through the
10 boiler. You have a different pump that circulates
11 the system, and in a retrofit situation, you may have
12 had a system pump that also did the boiler. It was
13 one pump, but with the high efficiency adders, we now
14 add these other pumps.

15 So is that -- when we talk about that, are
16 we talking about the pump that pumps through the
17 boiler, or the pump that delivers to the entire
18 system. Also in some of these systems, you have
19 multiple system pumps.

20 You might have zone pumping where you
21 could have four, five, six circulators for different
22 wings of the building, and yet another boiler pump

1 that's going to vary greatly, depending on the
2 installation. So when we talk about the pump power,
3 what are we talking about?

4 MS. SINGLA: So we are talking about the
5 system pump that pumps water to the building, and it
6 is a simplification. Right now we're assuming one
7 pump that pumps water to the building. We didn't --
8 but we would appreciate any data that you have on
9 number of installations with multiple pumps or
10 different configurations, because right now it is
11 just a simplification of one pump for water.

12 MR. BROOKMAN: Harvey.

13 MR. SACHS: This is Harvey. Again, this
14 may get me in trouble, but as I'm thinking about
15 trends that I don't particularly get excited about, in
16 smaller unitary equipment, where the water source is
17 having a pump taking out of the rating. We know
18 there's always a pump associated with that system,
19 but we also know that it is generally a
20 field-selected or building design-selected pump.

21 And it seems to me that conceptually,
22 there is an important difference between the system

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1 pump for commercial boilers that is controlled, to
2 some extent, by 90.1, and any internal pump required
3 for doing that local recirc control, the temperature
4 drop at part load that Chuck I think is referring to,
5 the one before the so-called secondary loop.

6 So I think that y'all are going to have to
7 be real careful in defining what really is integral
8 to the boiler, as opposed to how to treat that which
9 is integral to the distribution of the heat transfer
10 fluid into the building itself. I don't have any
11 answers.

12 MR. BROOKMAN: Okay, thank you. Chuck.

13 MR. WHITE: It's Chuck White again, and in
14 small boilers, it's probably provided with the
15 boiler, though it could very well be. But as the
16 systems get larger, those system circulating pumps
17 are diverse. I mean there's a wide variety of
18 selections, choices. Even for an individual three
19 million BTU boiler, I have lots of possible scenarios
20 of how I might pump it.

21 I can pick -- I can go to a catalogue and
22 pick a pump that will give me a certain flow of

1 certain pressure. I could probably pick five of
2 them, and they will all have different operating
3 efficiencies. So I appreciate that this is a big
4 concern, and my background in my family business was
5 an engineering approach to everything and what can we
6 do to be the most efficient.

7 I know firsthand you can pick some pumps
8 that are very insulting to the electric bill. But
9 how you can make -- how you can pull that together to
10 get an average or a single case application, that's
11 going to be complicated, I think.

12 MR. BROOKMAN: Okay.

13 MR. SACHS: This is Harvey again, and with
14 respect to Question No. 16, on packaged boilers used
15 for both space heating and water heating, there's an
16 awful lot of activity that DOE's analysis will want
17 to at least be aware of. In 90.1 in the IGCC and
18 elsewhere, to limit applications of recirculating
19 loops, dead legs on recirculating systems because for
20 applications like schools and multi-store commercial,
21 there's a growing knowledge-base that we're pretty
22 inefficient when we just use recirculating loops of

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1 high temperature water, to mix it down for a few
2 gallons a day per lavatory.

3 So there may be an evolution away from
4 these predominantly hot water applications in some
5 types of office buildings. Early awareness of this
6 came from work by Hiller and Dinzey 20 years ago,
7 with the reduction in primary energy of 90 percent by
8 simply turning off the primary loop and substituting
9 a couple of tank resistance water heaters near the
10 lavatories.

11 MR. BROOKMAN: Go ahead, Frank.

12 MR. STANONIK: Something that Chuck just
13 mentioned, Frank Stanonik, AHRI, and again, maybe I
14 think this will make things easier. But you know, on
15 this whole issue of the pump energy, again, well
16 first of all we're talking about a regulation that
17 would, at least on the schedule right now, would go
18 into effect the middle of 2019, all right.

19 And DOE has rulemakings going on to look
20 at the efficiency of commercial industrial pumps, I
21 believe. So I think in the analysis, and again I
22 don't know how the schedules mesh, but the analysis

1 might need to look to what extent the impact of a DOE
2 regulation on commercial industrial pumps might have
3 an effect on pumps being used with and supplied with
4 boilers, commercial boilers.

5 MR. BROOKMAN: Robert Glass has a comment.
6 Robert, we think you're unmuted.

7 MR. GLASS: Okay. Yeah. The comment that
8 I had was in regards to the commercial boilers may or
9 may not be included with the boiler pump, because
10 manufacturers' reps or contractors generally have
11 their own pump manufacturer preferences, because
12 there are several that are out there, as well as
13 their particular choice of the type of pumps.

14 The manufacturer is generally providing
15 the flow and head requirements for each particular
16 boiler, and as long as a pump has been selected to
17 meet those requirements, the manufacturer is
18 generally fine, knowing that the boiler will be
19 operated properly as long as those flow and head
20 requirements are met.

21 So it's something we have to be very
22 careful about looking at trying to provide any

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1 requirements or taking this energy consumption into
2 place, because they are not necessarily provided by
3 the boiler manufacturer.

4 MR. BROOKMAN: Okay, thank you. Do we
5 have final comments here? We're about to move on.

6 MS. SINGLA: Now that we have gone over
7 the energy-use characterization, we will next discuss
8 the life cycle cost or LCC analysis. DOE performed
9 an indepth life cycle cost analysis. In this
10 analysis, the economic impact of amended energy
11 standards on the individual consumer were studied.

12 The LCC is used to determine the total
13 consumer cost over the lifetime of the equipment.
14 The total consumer cost is the sum of the installed
15 cost and the annual operating costs, where the future
16 operating costs are discounted to the year of
17 purchase and summed over the lifetime of the
18 equipment.

19 The payback period measures the amount of
20 time it takes consumers to recover the purchase price
21 of more energy efficient equipment through reduced
22 operating costs. DOE developed a spreadsheet model

1 which generated a Monte Carlo simulation to perform
2 the analysis. The analysis takes into account that
3 each commercial boiler installation is unique. It
4 calculates the LCC and payback period for a
5 representative sample of buildings.

6 This flow chart shows the inputs into the
7 life cycle cost and payback period analysis. The two
8 primary inputs into the analysis are the total
9 installed cost and the annual operating expenses.
10 The total installed cost is the sum of the consumer
11 price and installation costs.

12 We've already talked about the consumer
13 price and the markups and an engineering analysis.
14 We'll talk about installation costs in a few minutes.
15 The annual operating expenses are the sum of the
16 annual energy cost, annual repair costs and annual
17 maintenance costs. We'll talk about the maintenance
18 and repair costs a little while later today.

19 For annual energy costs, we've already
20 talked about the annual energy use of the boiler.
21 We'll talk about the cost of energy, energy prices a
22 little while later. So the annual operating expenses

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1 are summed up over the lifetime of the boiler, the
2 applied discount rate and an energy price trend, and
3 we get the lifetime operating expenses.

4 We add the total lifetime operating
5 expenses to the total installed cost, in order to get
6 the total life cycle cost. All of these inputs vary
7 by installation and by geographic region, and many of
8 the inputs are not single point values but rather
9 distributions.

10 The installation cost represents the labor
11 and material cost necessary to install the boiler.
12 DOE calculated installation costs using 2013 RSMeans
13 mechanical-cost data, manufacturer literature and
14 information from experts.

15 The key components of the installation are
16 the basic installation costs, venting and condensate
17 removal for condensing boilers. The analysis
18 accounted for different installation costs for the
19 following considerations. Gas-fired versus oil-fired
20 boilers, natural draft versus mechanical draft,
21 condensing versus non-condensing, replacement
22 installations versus new construction installations,

1 and any specific venting requirements.

2 MR. BROOKMAN: Chuck.

3 MR. WHITE: This is Chuck White. So in
4 your venting information, in the case of retrofits
5 with going to a PVC-vented high efficiency product,
6 leaving the quote-unquote orphaned water heater into
7 a vent, do you allow for vent kits or some means of
8 handling that water heater that's left behind?

9 MS. SINGLA: We do account for a fraction
10 of orphaned water heaters. I'll talk more about each
11 of these components, including venting, in just a few
12 minutes.

13 So the basic installation costs apply to
14 both replacement and new construction installations.
15 Common to both replacement and new construction
16 installations are the cost of placing and setting up
17 the boiler, connecting gas piping and connecting
18 water piping. Specifically for replacement
19 situations, we also have an additional cost for
20 removing the old boiler and disposing of it.

21 MR. BROOKMAN: Frank Stanonik.

22 MR. STANONIK: All right. So in a -- and

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1 again, I appreciate we're talking about commercial
2 products and, you know, in a replacement situation,
3 it doesn't -- okay. So I have an existing
4 installation and my customer has decided they want to
5 upgrade to a condensing-design boiler.

6 It doesn't look like in that situation
7 you're considering that there might be additional
8 system costs to in fact, let's say renovate the
9 system, so that in fact it can accommodate a
10 condensing boiler and return the water at a low
11 enough temperature for the product to operate as a
12 condensing boiler.

13 I guess the question here is, I mean was
14 that a conscious decision to just ignore that, or am
15 I missing something?

16 MS. SINGLA: So in order to account for
17 this, we didn't actually have any data about the
18 downstream systems that would need to be
19 reconfigured. So instead, we assumed a fraction of
20 condensing boiler installations, a fraction of
21 replacement condensing boiler installations that are
22 installed -- where the water temperatures wouldn't

1 actually be that low. So like the condensing boilers
2 that are operating at higher return water
3 temperatures.

4 MR. WHITE: Is that --

5 MR. BROOKMAN: Chuck.

6 MR. WHITE: Chuck White. Is that a
7 significant fraction, or is your fraction -- the
8 fraction is boilers installed would be condensing
9 versus non-condensing, because in retrofit
10 situations, I would hazard most of them are going to
11 be condensing boilers going in at a fair portion of
12 the time are going to be non-condensing. Maybe I've
13 jumbled up that question.

14 MS. SINGLA: So I don't have the exact
15 fractions, but for condensing boiler installations,
16 we did assume a fraction based on the year that the
17 building was built. So we actually assume that older
18 buildings have more likelihood of being run,
19 operating at non-condensing temperatures.

20 MR. BROOKMAN: Frank Myers has a question
21 or pardon me, a comment. "Life cycle costs does not
22 seem to include the accelerated replacement resulting

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1 from selection of higher efficiency equipment."

2 MS. SINGLA: So we'll talk about lifetime
3 in just a few moments. But we do not assume --
4 sorry, it's about the -- could you repeat it?

5 MR. BROOKMAN: Yes. Life cycle costs does
6 not seem to include the accelerated replacement
7 resulting from selection of higher efficiency
8 equipment.

9 MS. SINGLA: Great. So we do -- we'll
10 talk about repair rates in just a minute. But sorry
11 Alex, did you want to address that?

12 MR. BROOKMAN: Alex Lekov.

13 MR. LEKOV: I would say that the lifetime
14 is presented as a distribution of lifetimes. So
15 although not explicitly mentioned, this distribution
16 would to a certain extent account for this early
17 replacement that Frank is mentioning.

18 MR. BROOKMAN: Oh okay, because it's a
19 distribution, yes. Okay.

20 MS. SINGLA: So all boilers that are
21 installed indoors need to be vented. Non-condensing
22 boilers exhaust high temperature flue gases, which

1 heat the inside of a vent above the dew point, so
2 there is no condensation. If condensation does
3 occur, this could damage the vent or the boiler
4 itself. DOE assumes that in non-condensing
5 installations, Type B vents and stainless steel vents
6 are the most common venting materials used. DOE also
7 assumes that masonry chimneys are used in replacement
8 installations, but are uncommon in new construction.

9 More efficient, low-temperature condensing
10 boilers condense the water vapor, thus increasing
11 efficiency by rate and heat loss. The condensate is
12 fed to a drain. The flue must be able to withstand
13 the condensation. DOE assumes that certain types of
14 plastic and stainless steel are the most common
15 venting materials for condensing boilers.

16 DOE assumes that plastic is more common in
17 smaller vents, that is less than six inches in
18 diameter, and that stainless steel is more common in
19 larger vent installations. DOE determines the
20 relationship between vent diameter and input capacity
21 of the boiler, based on boiler manufacturer
22 literature and applies this to the vent-sizing

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1 analysis.

2 Condensate removal is required for all
3 condensing boilers. The excess condensate from the
4 condensing boiler must be deposited to a drain. So
5 for all replacement and new construction
6 installations, we assume the cost of a condensate
7 pipe.

8 A condensate pump is sometimes required if
9 a drain is not near the boiler and the condensate has
10 to be pumped to a drain. So we that that condensate
11 pump is in about a quarter of all condensing boiler
12 installations. A condensate neutralizer, sometimes
13 the condensate needs to be neutralized before pouring
14 it down it down the drain. So we assume that this is
15 required in about an eighth of all condensing boiler
16 installations, and an additional electrical outlet.

17 We assume that half of the condensing
18 boiler installations that require a condensing pump
19 or a condensate pump also require an additional
20 electrical outlet.

21 MR. BROOKMAN: Frank Myers would like to
22 comment. Frank, we think you're unmuted.

1 MR. MYERS: Yes. This is Frank Myers. I
2 hate to go back. I was trying to get a moment in
3 when we were talking about condensating boilers or
4 higher efficiency boilers requiring system redesign,
5 and there was some comment that a certain percentage
6 of those in a variable might be something that's
7 considered in the analysis.

8 I think that's completely incorrect.
9 Boilers in commercial buildings are almost always
10 designed in by the engineer, and the water
11 temperatures out and the return water temperatures
12 back to the boiler are a part of that system design.

13 So if the current system is designed with
14 a traditional, for example, 180 out, 160 degree
15 return, then adding a condensing boiler to that
16 system does nothing. It won't condense. So if
17 you're looking at the cost to upgrade to a higher
18 efficiency product, then you're looking at a total
19 redesign of almost all boiler systems that were
20 previously set for non-condensing. So it's not a
21 small factor; it's a huge factor.

22 MR. BROOKMAN: Okay. Thanks, Frank.

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1 MR. SACHS: Frank, this is Harvey, and as
2 I said earlier, I want to introduce into this a
3 review paper by Tom Durkin a decade or so from the
4 ASHRAE journal, in which we went through the process
5 and rationale for this kind of major retrofit of high
6 temperature boilers with low temperature condensing
7 systems. He broke out all of the system installation
8 costs.

9 Now those are a decade old now, but it
10 would seem to me that DOE is going to an enormous
11 amount of effort to interview manufacturers about the
12 costs of the boiler, and yet we're doing pretty high
13 level guesses on all the rest of it, instead of going
14 to the design engineers and asking them for their
15 experience with costing-out and bidding a whole bunch
16 of these actual jobs.

17 That would seem to be a very inexpensive
18 exercise, and if we have claims that these are very
19 significant system conversion expenses, as my buddy
20 Frank has suggested, I think it's incumbent on us to
21 get that into the analysis.

22 MR. MYERS: Harvey, I couldn't agree with

1 you more. Getting with the engineering community or
2 at the very least, I'm not familiar with the article
3 that you're speaking to. But someone in the
4 engineering community who has prepared what is
5 required to convert a system that is designed for
6 high return water temperature, utilizing a
7 non-condensing boiler into a system that will utilize
8 a condensing boiler and get any benefit whatsoever
9 from that condensing boiler. I think getting with
10 the engineering community is essential.

11 MR. BROOKMAN: Okay. Thanks, Frank.

12 MR. SACHS: Anecdotally, there's also an
13 awful lot of experience with this kind of
14 reengineering of schools in New England, where costs
15 became prohibitive to use non-condensing boilers. We
16 can start with the Vermont Energy Efficiency
17 Community, and there's pretty good case-study load up
18 there I'm pretty sure.

19 MR. BROOKMAN: Okay.

20 MS. SINGLA: So DOE requests comments on a
21 number of issues. DOE requests data on the fractions
22 of installations that would entail significant

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1 additional installation expenses. DOE seeks input on
2 how often plastic versus stainless steel venting is
3 installed for condensing boilers.

4 DOE seeks input on how often boilers have
5 direct venting, for both condensing and
6 non-condensing boilers. DOE seeks input on the
7 fraction of stainless steel venting in existing
8 boiler installations by efficiency.

9 MR. BROOKMAN: Harvey.

10 MR. SACHS: Please let me respectfully
11 suggest that these are all questions that you really
12 need to seek out input from the engineering
13 community. For example on 24, you're asking for
14 input on the fraction of stainless venting in
15 existing boiler installations by efficiency.

16 I suspect that that and a number of these
17 other questions also have a component that deals with
18 capacity. I just -- I think you need -- if your
19 hypothesis is that the system costs, as opposed to
20 boiler costs are important, you need to talk to the
21 system designers and the contractors who bid on and
22 go out of business or make a profit, depending on the

1 goodness of their bids.

2 MR. BROOKMAN: Can we speculate on 21, the
3 fractions of installations that would entail
4 significant additional installation expense?

5 (Off mic comment.)

6 MR. BROOKMAN: Okay, Chuck or Frank.

7 MR. WHITE: Which ends up being me. Chuck
8 White. In particularly smaller projects, probably
9 there's a high percentage of people just change out
10 what's there, and to try to figure out a way to get
11 the system temperature down every day and provide
12 total heat quantity, that would be significant
13 expense and I doubt in many instances that it's done.

14 The other mitigating factor there is most
15 of these products, the higher efficiency products,
16 have outdoor reset capability. So as it gets colder,
17 we make the water hot; as it gets warmer, we make the
18 water cooler, try to match the water temperature to
19 the load.

20 So the trade-off is what percentage of the
21 time is it designed? We're not going to be very
22 efficient at that small percentage. The next step

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1 down at 90 percent of design, we're probably not very
2 efficient there. But at some point, our percentage
3 of design gets us to a point where we are in that
4 more efficient operation of that boiler.

5 So I don't have data on times that you go
6 to that significant additional expense, but I could
7 certainly kind of conjecture what that might be.

8 Your Issue 22, I would say probably the plastic vent
9 is going to be a larger percentage in the smaller
10 capacities.

11 When you get up in the million, two
12 million, four million, the larger high efficiency
13 ones, you're going to start seeing more stainless.
14 But in the smaller product, I think you're going to
15 see probably predominantly plastic for most of it.

16 How often they have direct venting, I
17 think most people are going to put products in that
18 are the condensing mode. Probably most of the time
19 they do make it direct venting, but I don't have any
20 data to back that up.

21 Direct vent, if no one understands, is you
22 have a combustion air pipe and an exhaust pipe. So

1 we aren't taking room air, running it through the
2 combustion and ejecting it from the building. And I
3 have no idea on Item 24.

4 MR. BROOKMAN: Okay. Frank.

5 MR. STANONIK: I think Harvey had
6 indicated that all of these are in some way related
7 to I think the capacity of the boiler. That's
8 absolutely right, and just using direct venting as in
9 No. 23 as an example, again this rulemaking, I mean
10 you're looking at, you know, fairly small boilers.

11 But you very quickly get into a situation
12 where again the boiler has been installed in a boiler
13 room. I mean you again, looking at all of the huge
14 range of buildings that get included in this category,
15 this grouping.

16 You know, you have let's say older
17 buildings, where in fact you had a boiler room, and
18 that room was, for whatever reasons, located some
19 place that in fact probably, rather than direct
20 venting, if you get a big enough boiler, you
21 literally have louvers on the wall to provide air
22 into the room.

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1 And so, you know, there is, I think in
2 each of these cases, probably some -- a better than
3 rule of thumb kind of indication that, you know, if
4 you're in the capacity range of this, then you
5 probably have this happening, and once you get above
6 there, it becomes very rare.

7 We will try and provide some information
8 on this from wherever our members can determine. But
9 like I said in all of these cases, I think it will be
10 useful for the analysis to perhaps focus on a certain
11 range of capacities, as to whether these issues apply
12 or don't, because again, to me there's no question.

13 Let's just say we're talking about boilers
14 only over ten million. You could probably forget 22,
15 you could probably forget 23, and forget 24. But in
16 the inverse way, they're probably, you know. Anyhow,
17 so I think that's point made.

18 MR. SACHS: Okay. I'd like to go back --
19 this is Harvey again, and I'd like to go back to
20 Chuck's comments on No. 21, which basically is if I
21 design to load with a condensing boiler, there will
22 be design days when I'm likely to have to move up the

1 temperature into the non-condensing range.

2 But how much time that is I think, and I'm
3 really stating this as a question I'm asking, will
4 depend on the oversizing in the boiler. If I've got
5 twice as large a boiler as I need, and have it pump
6 sized for that flow, I'll push a lot more 140 degree
7 water through there or 120 degree water through there
8 on the design day, and have to -- or the 120 degree
9 water, and have to move into the non-condensing mode
10 a smaller fraction of the time.

11 So actually having a sense of how
12 oversizing the impacts, oversizing practices impact
13 this question would seem to me to be important. Am I
14 totally off base?

15 MR. BROOKMAN: Okay. Chuck.

16 MR. WHITE: This is Chuck White.

17 Oversizing certainly is a factor. It increases your
18 standby losses, etcetera. But the temperature, the
19 design temperature requirements drive the water
20 temperature, and that's based on your emitter
21 conditions.

22 So how many feet of baseboard do I have,

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1 how many square feet of radiant floor, how big are
2 the heating coils in the fan coil unit I have,
3 whatever that might be. So the -- if I can't get the
4 BTUs out of that emitter at a given water
5 temperature, I will have to increase the water
6 temperature.

7 So if my boiler's not big enough to get
8 that temperature, if I don't have enough heat to
9 raise it up to that level that I need, then yes, I
10 need a larger boiler. But it's not strictly driven
11 as a function of my boiler is too big, and especially
12 if I have a modulating device, then I will get some
13 turndown out of that just naturally.

14 There was something else I was going to
15 respond to. You've thrown me off of it.

16 MR. BROOKMAN: Let's move on to 25 and 26.

17 MS. SINGLA: DOE seeks input on where
18 buildings are typically located within different
19 types of buildings, and where the vents typically
20 terminate. DOE is interested is whether this changes
21 by geographic region or by boiler type.

22 MR. BROOKMAN: Just pause there. Can we

1 -- yes, Chuck?

2 MR. WHITE: I thought of what I was going
3 to say.

4 MR. BROOKMAN: Okay.

5 MR. WHITE: This is Chuck White. Would
6 DOE consider creating a survey with some standard
7 questions, that you could send out to contractors,
8 engineers, manufacturers, for some of these kinds of
9 things that you're interested in, that we don't have
10 four or five or six industry groups out there asking
11 what we think you want to ask, that --

12 And if that needs, you know, some refining
13 or some help crafting those questions, I'm certainly
14 volunteering Harvey to do it.

15 (Laughter.)

16 MR. WHITE: But that might get you better
17 answers and better information, more uniform
18 information. Just a suggestion.

19 MR. BROOKMAN: Okay, thank you.

20 MR. SACHS: Well, this is Harvey --

21 MR. GLASS: Robert Glass.

22 MR. BROOKMAN: Go ahead.

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1 MR. GLASS: This is Robert Glass. I have
2 a question from the Issue 24, one that was talking
3 about the percentage or the fraction of stainless
4 venting used in existing boiler installations. One of
5 the things that I think DOE needs to be cognizant of
6 is that the same boiler installed in a Category 1
7 vent condition vertical vent, may be able to use the
8 vent-type venting materials.

9 But if the same boiler is installed with a
10 horizontal vent and it changes the category, then
11 stainless steel venting may be required there. So
12 either a rephrasing of the statement if it's relating
13 to condensing versus non-condensing or just
14 condensing products, DOE needs to be aware that
15 standard installations may still be using stainless
16 steel because of the categorization of the vent under
17 that type of installation.

18 MR. BROOKMAN: Okay. Harvey.

19 MR. SACHS: Not getting too far into the
20 weeds, if DOE is thinking survey, I think it has to
21 start with interviews, to find out what the
22 significant questions are.

1 MR. BROOKMAN: Okay. We're back to 25,
2 input on where boilers are typically located. We
3 started to cover this, and does it change based on
4 geographic region or boiler type? We've kind of
5 touched on this a little bit. Chuck.

6 MR. WHITE: This is Chuck White. It's
7 going to be all over the place, depending on some
8 places may have basements, some places may have
9 particular boiler rooms. There may be small
10 equipment rooms. I know of some hotel properties
11 that put them on every floor, so you have a high
12 efficiency boiler servicing each floor, kind of a
13 retrofit arrangement that somebody did, but that
14 worked for what they were doing.

15 They could be at remote boiler rooms.
16 They could vent through sidewalls, they could vent
17 through roofs. They could go up masonry chimneys,
18 stainless e-vent depending on the particular product.
19 So this is -- I don't know that there is a typical
20 for this.

21 MR. BROOKMAN: You couldn't say for a
22 certain building type with a certain vintage and a

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1 certain region, that this would be a typical sort of
2 a --

3 MR. WHITE: I would say probably for a
4 hospital. Typically, there's going to be a
5 powerhouse, and it's going to be a remote building.
6 For a hotel, it's typically going to be a basement or
7 an equipment room. It could be a penthouse.

8 Offices, apartment buildings could be
9 similar, either a penthouse type arrangement or a
10 basement or equipment rooms located on the utility
11 side of the building, not at the, you know, next to
12 the front door. But it's one of the versatilities of
13 hot water heat or steam, you're passing the product
14 around in a relatively small pipe.

15 So I don't need large duct chases. I
16 don't need to dedicate specific areas. So you can
17 move that around to fit the floor plan as a client
18 dictates or wants out of their facility. Everybody
19 wants to maximum rentable space or productive space.
20 So these things tend to be relegated to not front and
21 center.

22 MR. BROOKMAN: Right. 26.

1 MS. SINGLA: All right. DOE seeks data on
2 how often common venting occurs in multiple boiler
3 installations, and whether commercial water heaters
4 are commonly vented with commercial boilers.

5 MR. MYERS: This is Frank Myers. Are you
6 able to hear me?

7 MR. BROOKMAN: We hear you, Frank.

8 MR. MYERS: Oh thank you. Common venting
9 is a very sensitive issue. Most, but not all
10 condensing boilers today vent individually. There
11 are some that at the boiler, they might have
12 multiples that they have worked with their
13 certification agency to come up with a multiple
14 venting arrangement.

15 But if I were in -- and I have looked at a
16 number of condensing boilers in the marketplace, and
17 the most common is a single vent for each boiler. So
18 if you had three boilers, you'd have three vents. If
19 it's non-condensing equipment, they are most commonly
20 vented together.

21 There is a number -- there are a number of
22 projects going on right now, looking at what is

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1 required to common-vent condensing boilers, what
2 safety certification might be required to do that,
3 and there may well be some research that is required,
4 in order to be able to finalize that.

5 MR. BROOKMAN: Okay, thank you.

6 MR. MYERS: The second item there are
7 water heaters commonly vented with commercial
8 boilers, in the non-condensing area of commercial
9 buildings, yes they are frequently vented together.
10 But again, if they're condensing boilers and
11 condensing water heaters, not 100 percent but most of
12 them are separately vented.

13 MR. BROOKMAN: Okay, thank you. And of
14 course for anybody on the call or here in the room,
15 the Department would really appreciate these comments
16 in writing. Any additional thoughts on Issue 26?
17 Frank.

18 MR. STANONIK: Frank Stanonik, AHRI. I
19 think, and again, as we talked about it in the
20 preceding slide, even this issue of commonly vented
21 commercial water heaters and commercial boilers,
22 there's probably a boiler capacity, boiler size issue

1 that you've quickly moved from it something being
2 usual to something being very rare.

3 Again, you know, I'm envisioning -- you
4 have a very, very large boiler, and the building's
5 hot water needs may not be anywhere near what its
6 heating needs are, and all of the sudden, the concept
7 of common venting becomes more than problematic,
8 because your common vent size would be potentially so
9 large that when the boiler wasn't firing, you're
10 going run into a vent problem on the water heater,
11 and you know, it's a non-heating season or something.

12 So again, I think there's a capacity
13 component that again, you go from okay, this happens
14 to well, usually not.

15 MR. BROOKMAN: Okay. I'm looking ahead in
16 the slides that are forward from here, and there are
17 four or five different segments to be discussed for
18 LCC and payback trade analyses. So I'm going to
19 suggest we take a break now for lunch. It's 12:25.
20 We've made a lot of progress here. We still have a
21 fair amount of rather detailed content to cover.

22 So I want to make sure we're fresh to do

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1 that. 12:25. We'll break for an hour for lunch. I
2 think most of you are familiar with the Forrestal
3 Building. Please wear a badge visible. This room
4 will be watched. It will be secured. You can leave
5 your stuff here, and if you go to the big cafeteria,
6 to run back through the security portal you might
7 need a picture ID.

8 There's also a Subway shop down on the
9 ground floor, near the coffee shop down there. So
10 see you back here at -- to start at 1:25. Harvey.

11 MR. SACHS: Would it be out of line to ask
12 -- [not audible]

13 (Whereupon, at 12:25 p.m., a luncheon
14 recess was taken.)

15

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1 that they maintain their equipment regularly, then
2 DOE assumes that the gas-fired hot water boiler will
3 be maintained at the frequency as specified in
4 RSMMeans. If the owner indicates that they do not
5 maintain their equipment regularly, then DOE assumes
6 that the maintenance occurs one-third as frequently
7 as specified in RSMMeans.

8 The labor hours and costs are based on the
9 2013 RSMMeans facility maintenance and repair data
10 book. This includes separate labor costs for steam
11 boilers versus hot water boilers, and for small
12 boilers versus large boilers.

13 The material costs are also based on
14 RSMMeans, and we include an additional common state
15 neutralizer cost for condensing boilers. We assume
16 that the maintenance is the same across all
17 efficiency levels, other than the condensate neutral
18 costs and across all equipment classes.

19 The repair cost is the cost to the
20 consumer of replacing or repairing components in a
21 boiler that has failed. The labor hours and costs
22 are based on the 2013 RSMMeans data book, and material

1 costs are based on RSMMeans, as well as the
2 engineering analysis. The component failure rate is
3 given in this chart on the slide. We have a mean
4 failure year. We assume a Weibull distribution for
5 the component lifetimes, for each component lifetime.
6 The mean year is what is written in the slide. So we
7 have mean year -- mean failure year and the repair
8 rate.

9 Also, the analysis assumes that all
10 boilers have a one year warranty on parts and labor,
11 and a ten year warranty on the heat exchanger. So
12 DOE has a number of comments or a number of requests
13 in relationship to maintenance and repair.

14 So DOE requests comments on frequency and
15 cost of maintenance, major repair issues, repair
16 frequency and repair costs for commercial boilers
17 that meet the minimum energy efficiency standard, as
18 well as for higher efficiency boilers.

19 DOE seeks input on how often boiler
20 maintenance is performed by on-site maintenance staff
21 versus external contractors, specifically for hot
22 water boilers, resisting boilers and small boilers

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1 versus large boilers. DOE seeks input as to how
2 often, in the event of a heat exchanger failure, the
3 heat exchanger alone is replaced, versus the entire
4 boiler being replaced.

5 DOE is interested in knowing whether this
6 varies with equipment costs or varies with condensing
7 versus non-condensing.

8 MR. BROOKMAN: Frequency and cost of
9 maintenance. Let's start there. Chuck.

10 MR. WHITE: This is Chuck White. While I
11 cannot comment on costs, but certainly the steam
12 boiler annual maintenance is on target. Larger hot
13 water boilers probably do have annual service,
14 probably not as much as steam but more than minimal.
15 I think most of them are going to have some annual
16 service to them. I can't comment on the cost issue. The
17 on-site versus the external contractors --

18 MR. BROOKMAN: Before you move on, is
19 there a difference between minimum efficiency boilers
20 and higher efficiency boilers?

21 MR. WHITE: I don't really think so,
22 particularly in steam. No matter what -- I'm not

1 exactly sure what a high efficiency steam boiler is
2 anyway, but oh, I probably shouldn't have said that
3 out loud. But compared to high efficiency water,
4 hard to be really high efficiency in steam. But I
5 think they're both going to have service pretty
6 routinely. On site, external, that's going to be a
7 function of the -- really the facility it's in, if
8 they have competent people to do that kind of stuff.

9 So like hospitals and larger apartment
10 buildings, things like that probably are going to do
11 on-site, unless it's repair of specific problems. I
12 mean if it's routine maintenance, typical stuff
13 probably, the on-site staff's going to do a lot of the
14 typical. But --

15 MR. BROOKMAN: Would that correlate more
16 with the size of the boiler?

17 MR. WHITE: Yes the large -- especially
18 the larger is probably going to be more external.
19 But not every time, and the heat exchanger failure,
20 that's really -- that really is directly related to
21 maintenance, particularly in steam boilers. But if
22 you're not maintaining steam boilers, you're probably

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1 going to be breaking sections or tubes or what have
2 you.

3 Whether you change the heat exchanger or
4 whether you change the boiler, bigger boilers you're
5 probably going to repair, change parts; smaller
6 boilers, you'll probably change the unit. But not
7 100 percent either way.

8 MR. BROOKMAN: Okay, good. Thank you.
9 Additional thoughts on these questions? Okay.

10 MS. SINGLA: Another key input into the
11 life cycle cost analysis is the boiler lifetime. DOE
12 defines lifetime is the age when the commercial
13 boiler is retired from service. DOE assumes that the
14 lifetime of a boiler is the same at different
15 efficiency levels, and the same across all equipment
16 classes.

17 DOE assumes a medium lifetime of 24.8
18 years, based on its literature review of boiler
19 lifetimes. DOE uses a Weibull distribution, the one
20 pictured here on the slide, to represent the boiler
21 lifetime. In order to derive the parameters for
22 defining this distribution, we derived some of the

1 parameters from the literature review, and derived
2 some from parameters typical of appliances.

3 You can see all of the sources found on
4 the literature review, as well as details on the
5 methodology in Appendix 8-F. So we're also
6 requesting comments on lifetime. So specifically,
7 DOE requests comments about the methodology used to
8 determine equipment lifetimes for commercial boilers,
9 and DOE seeks data that projects boiler lifetime,
10 particularly for non-condensing versus condensing
11 boilers.

12 MR. WHITE: This is Chuck White. The 24.8
13 is kind of an unofficial industry mantra is boilers
14 in 25-year kind of devices. I don't really have a
15 way to weigh in on the condensing versus the
16 non-condensing. One of the condensing technologies,
17 the current condensing technology is 25 years is kind
18 of a stretch for some of those products. So I don't
19 -- I really don't have an opinion on how to quantify
20 that aspect.

21 MR. BROOKMAN: Okay, Frank.

22 MR. STANONIK: Frank Stanonik, AHRI. In a

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1 lot of those lines, and we've voiced this concern
2 before, the -- I mean the fact is that the use of
3 condensing technology in boilers, even on the
4 commercial side, really hasn't been enough of a field
5 experience to -- I'll say to apply, let's say, the
6 same technique that you might do for non-condensing
7 boilers, because we're probably --

8 If mean if you were to say okay, they have
9 an average life of 25 years, in fact 25 years ago
10 there were very, very few condensing boilers being
11 installed. So we just don't really have the field
12 experience at this point, I think, to substantiate
13 that the typical lifetime of a non-condensing boiler
14 necessarily translates directly to condensing
15 designs.

16 And so I think just it needs to -- and
17 again, I don't know that we can get our hands on any
18 data from the field that might show something. But
19 it just needs to kind of be recognized that, you
20 know, if you looked at -- we really just don't have
21 the field experience to have a good fix on it okay, is
22 it different.

1 MR. BROOKMAN: Okay. Frank Myers, please
2 unmute your phone. Let's hear from you.

3 MR. MYERS: Okay. Can you hear me now?

4 MR. BROOKMAN: Yes, yes.

5 MR. MYERS: Thank you. On the lifetime of
6 equipment, that's usually determined by two factors.
7 One is payback for replacement of equipment due to
8 higher efficiency, and the other is when the cost of
9 maintenance is seen by the owner as exceeding the
10 benefit of maintaining the old equipment. Would they
11 rather spend the money to repair or to replace?

12 So and to 28, Frank Stanonik is correct.
13 We don't have long years of history to make a
14 definitive statement about whether or not the
15 traditional lifetime of boiler applies to
16 non-condensing.

17 But early evidence is that the products
18 are more sophisticated, have to deal with corrosive
19 condensate and as a result tend to have shorter lives
20 than the non-condensing counterpart that they might
21 be replacing, assuming the design of the building can
22 accept and utilize such a replacement.

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1 MR. BROOKMAN: Hmm, okay. Thank you.

2 Geoff Halley, please, your turn.

3 MR. HALLEY: Yes. I think that the 24.8,

4 25 years is a good number for conventional boilers.

5 A lot of it depends on the actual maintenance that's

6 done on the thing, the day-to-day operational chores,

7 if you like, that the operators have to go through,

8 like blowing water down on steam boilers, so on so

9 forth.

10 But I think a better number for

11 conventional boilers is probably around 15 years, you

12 know. Like Frank Myers has just said, it looks as

13 though it could be shorter. I've not actually heard

14 comments from manufacturers of convention boilers,

15 but customers are going to be a little bit upset or a

16 lot upset, you know, 15 years down the road from when

17 they buy it and they find out that it's not going to

18 last as long as a conventional boiler.

19 So I think that possibly we ought to be

20 delineating between condensing boilers and DOE,

21 rather than having across the board 25 years.

22 MR. BROOKMAN: Okay, thank you.

1 MR. MYERS: This is Frank Myers, PPI
2 Industries again. Going back, I think it's one
3 slide, talked about the maintenance costs and
4 frequency of repair for condensing versus
5 non-condensing, and also the issue of self-service
6 versus external service.

7 This is another area where a well-worded
8 survey form could be either physically applied by
9 calling and asking for answers to questions, or sent
10 out to boiler service companies. They do this every
11 day, and would be able to give you answers to both
12 the cost frequency and even help answer some of the
13 questions about the frequency differences between
14 non-condensing and condensing equipment.

15 MR. BROOKMAN: Okay. Thanks, Frank.

16 MR. SACHS: This is Harvey, and I'm
17 certainly very naive about these issues. But one of
18 the things we have discussed is that there are
19 multiple materials used in the heat exchangers of
20 these devices, including copper, cast iron, steel and
21 on the condensing side stainless steel.

22 So it would seem that the issue of the

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1 heat exchanger material is likely to be as relevant
2 as the issue of the condensing versus non-condensing,
3 and if you're going to go to the trouble of doing
4 this sort of survey, which we'd certainly support, we
5 need to make sure covering the variables and have a
6 reasonable chance of making a difference.

7 MR. BROOKMAN: Okay, thanks.

8 MR. SACHS: I personally have long-favored
9 the use of unobtanium in the primary heat exchanger.

10 MR. BROOKMAN: Now we are moving on.

11 MS. SINGLA: Average monthly energy prices
12 were determined for CBECS and RECS regions based on
13 EIA data. 2012 annual electricity prices were
14 derived from EIA Form 826 data, which includes
15 energy prices by State. Data for natural gas prices
16 were determined from the EIA's natural gas navigator,
17 which includes natural gas prices by State.

18 2012 average fuel oil prices were
19 collected from EIA's state energy consumption price
20 and expenditure estimates, which includes fuel oil
21 prices by State. For areas with more than one State,
22 the analysis weighs each State's average price by its

1 number of commercial buildings and households.

2 Marginal prices from a consumer
3 perspective are those prices that consumers pay or
4 save for their last unit of energy used or saved.
5 For utilities, marginal energy costs are the costs
6 experienced by utilities for the last kilo[watt]/hour of
7 energy produced.

8 A utility's marginal cost can be either
9 higher or lower than its average price. We apply
10 average energy prices to the energy use of the
11 baseline. We apply marginal energy prices to any
12 energy savings in natural gas and electricity.
13 Marginal energy prices were derived from EIA data.

14 Future energy prices were based on EIA's
15 projections from 2019 to 2040. DOE multiplies the
16 prices described in the previous slide by the
17 forecasts of annual average price changes in EIA's
18 AEO 2014. The figure shown here is the projected
19 commercial National gas price trend.

20 Because the EIA projection only goes to
21 the year 2040, to estimate the trend after the year
22 2040 we use the average rate of change from the years

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1 2030 to 2040. This is based on guidelines provided
2 to the Federal Energy Management Program by EIA.

3 The projected energy price for each of the
4 nine census divisions was applied to each building
5 example, based on the building's location.

6 The discount rate is another input into
7 the LCC analysis. The discount rate is the rate at
8 which future expenditures and savings are discounted
9 to establish their present value. Discount rates are
10 applied to all annual operating expenses in the LCC
11 analysis, including energy cost, repair costs and
12 maintenance costs.

13 DOE estimates discount rates separately
14 for commercial and residential end users. For
15 commercial end users, DOE calculates the commercial
16 discount rate as the weighted average cost of
17 capital, using the capital asset pricing model.

18 Damodaran Online is a widely used source
19 of information about company debt and equity
20 financing for most types of funds. This was the main
21 source of data for the discount rates analysis. You
22 can refer to Appendix 8-G for more details.

1 So DOE seeks comments about whether its
2 planned approach for estimating discount rates for
3 commercial boilers.

4 MR. BROOKMAN: And are there other methods
5 or sources that would be more appropriate if you
6 don't like this one. No comment here. No? Chuck.

7 MR. WHITE: Okay. No comment here.

8 MS. SINGLA: So DOE recognizes that
9 consumers today are already purchasing equipment
10 that's higher than the standard. DOE recognizes by
11 the year 2019, when this new standard will take
12 effect, there will be even more consumers purchasing
13 equipment that is higher than the standard.

14 DOE derived efficiency distributions by
15 equipment costs for commercial boilers for the base
16 case, that is for the year 2019. DOE did not have
17 access to sales data describing the actual
18 distribution of efficiencies in the base case or in
19 the current sales today.

20 So instead, DOE based the estimates of the
21 distribution of efficiencies on the AHRI models
22 database. We looked at the models directories from

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1 2007 to 2014, we determined trends and projected the
2 trends forward to the year 2019.

3 So DOE requests data to characterize the
4 current distribution of commercial boiler
5 efficiencies in the market. DOE also requests data
6 on efficiency distribution and on the likelihood and
7 degree of improvement in efficiency of commercial
8 boilers in the next five to ten years, as a result of
9 market forces or industry trends.

10 MR. BROOKMAN: Frank.

11 MR. STANONIK: Frank Stanonik, AHRI. As I
12 mentioned earlier today, we certainly will try and
13 provide some of the data on distribution of products
14 by efficiency in our comments. As far as the degree
15 of improvement, we will also try and address that,
16 although I'm fairly confident that there will be
17 continued improvement. The condensing boilers in
18 both the residential and commercial side are still
19 having growth.

20 MR. MYERS: This is Frank Myers, PPI
21 Industries. Both here and previously, you have used
22 the AHRI directory I believe inappropriately, that

1 will likely lead to faulty conclusions. That is the
2 existence of a condensing or the existence of a
3 non-condensing product in that listing has no bearing
4 on how many are sold.

5 An example would be that when you're
6 looking at atmospheric and mechanical draft, looking
7 at that information, the atmospheric products,
8 because there's a very low cost to maintain them from
9 years ago, when they were entered into the program,
10 there's a likelihood that a manufacturer will
11 maintain those listings until it's not beneficial to
12 them, and then add in a new mechanical draft, which
13 may be where all of their sales are, or almost all of
14 their sales. But they maintain lots of atmospheric
15 listings, because it's easier for them to maintain
16 them.

17 There's not a link between the sales
18 volume and the number of listings of any particular
19 product type, whether it's atmospheric, mechanical or
20 condensing/non-condensing.

21 MS. SINGLA: Thank you for your comment.
22 I think hopefully Frank is able to provide data that

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1 would help address this.

2 So this table shows the results of the LCC
3 analysis for one equipment class. This is the
4 gas-fired small hot water mechanical draft boiler.
5 So it's all six efficiency levels considered,
6 including the base case efficiency. The values in
7 parentheses are negative values.

8 MR. BROOKMAN: Let's just pause here.
9 Geoff Halley, please, you're up.

10 MR. HALLEY: Hello?

11 MR. BROOKMAN: Geoff, yes.

12 MR. HALLEY: Yes. I didn't really have
13 much of a comment actually with this. But I just
14 wonder what a reasonable payback period is at this
15 point in time, because they look awfully high to me,
16 these payback periods, and certainly, you know, at
17 one time not too long ago, you know, if you were
18 beyond two or three years payback, it wasn't an
19 acceptable project.

20 MR. BROOKMAN: So you're referring to
21 Slide 81, and do you wish to say anything more
22 specific?

1 MR. HALLEY: No. I just, you know, while you've
2 got negative life-cycle cost as well, you know.
3 Does it make sense to go to these high efficiency
4 boilers from a business point of view?

5 MR. BROOKMAN: Okay. Okay, thank you. Do
6 you want to just cover the highlights on this slide?

7 MS. SINGLA: Yes, so that was basically
8 it. These values are average value across all the
9 ones that we did. You can see the complete -- for
10 each equipment class, you can see the complete
11 results in Chapter 8.

12 MR. BROOKMAN: Frank.

13 MR. STANONIK: Frank Stanonik, AHRI.
14 Again, I haven't read through all the TSD material.
15 But I'm just curious. On this particular slide, the
16 life-cycle cost for Level 6 is more than the life
17 cycle cost of the baseline unit.

18 We can see the installed cost as
19 significantly different. The savings is about \$1,600
20 a year. If you ran that backwards I guess 25 years,
21 that would probably -- that probably would cover the
22 difference in installed cost.

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1 My question is what's contributing to the
2 high life-cycle cost that we're not seeing here?

3 MS. SINGLA: So, I don't know if you low
4 calculation right now, but we include a discount rate
5 also. So that's part of it. But it's, you know,
6 there's no single answer. It's all the inputs that
7 we went over.

8 MR. STANONIK: Okay, all right. That may
9 explain some good part of it, okay.

10 MR. BROOKMAN: Additional comments on
11 these LCC and payback period analysis results?

12 (No response.)

13 MR. BROOKMAN: Okay.

14 Shipments and National Impact Analysis

15 MS. SINGLA: We're ready to move to NIA?
16 All right. So next we'll talk about the shipments
17 and the National Impact Analysis. So we've already
18 talked about the life-cycle cost analysis and all the
19 inputs that go into that.

20 The next step is to determine the
21 shipments, and then use that together with the
22 outputs of the life-cycle cost analysis, in order to

1 determine the national impact. The purpose of a
2 shipments analysis is to estimate the annual
3 commercial boiler shipments for each equipment cost
4 over the analysis period. The shipments analysis is a
5 necessary input into the National Impact Analysis, as
6 well as the Manufacturer Impact Analysis. The
7 National Impact Analysis or the NIA estimates the
8 national energy savings and national economic impact
9 on consumers from commercial boiler energy
10 conservation standards at different efficiency
11 levels.

12 The shipments model forecasts the
13 commercial boilers that would be expected to be
14 shipped between 2019 and 2048, both with and without
15 new energy conservation standards. The shipments
16 model starts from a historic base year and calculates
17 retirements and shipments by market segment for each
18 year in the analysis period. This produces the total
19 equipment stock for each year of the analysis period.

20 The equipment stock efficiency
21 distribution is calculated for the base case and for
22 each standards case for each equipment class. The

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1 equipment stock efficiency distribution is used in
2 the National Impact Analysis to estimate the total
3 costs and benefits associated with each efficiency
4 level.

5 The shipments model considers three
6 different equipment placement channels. Those are
7 new construction, replacements and new owners. The
8 shipments model also accounts for the impact of
9 standards on shipments using price elasticities.

10 DOE uses multiple data sources in the
11 shipments model. DOE uses historical annual
12 shipments. DOE had historic annual shipments for one
13 year for commercial boilers, that was the year 2007,
14 for which we had -- for which we had commercial
15 boiler shipments disaggregated by fuel type.

16 In order to expand the historical
17 shipments beyond the year 2007, DOE used residential
18 boiler shipments data. Residential boiler shipments
19 data was available from 1960 to 2013, from data from
20 Appliance magazine, the Gas Appliance Manufacturers
21 Association and the Energy Star program.

22 So based on the trends seen in the

1 residential boiler shipments, DOE applied that to the
2 commercial boiler shipments, to the 2007 commercial
3 boiler shipments, and with that, they were able to
4 expand the commercial boiler shipments.

5 DOE disaggregated between product classes,
6 that is, steam boilers versus hot water boilers, and
7 mechanical draft versus natural draft boilers, based
8 on the AHRI model directories from 2007 to 2014.

9 Another input into the shipments analysis
10 is the retirement function. The retirement function
11 is based entirely on the lifetime distribution, which
12 we've already discussed.

13 DOE also calculated shipments to new
14 construction. In order to do this, DOE estimated the
15 market saturation. That is, the number of buildings
16 with boilers installed compared to the total number
17 of buildings. This fraction came directly from CBECS
18 and RECS.

19 DOE obtained new building starts data and
20 projections from AEO 2014. So using these new
21 building starts projections, along with the market
22 saturations, we were able to determine the shipments

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1 to the new construction market. DOE also accounted
2 for product-class switching.

3 The analysis based a split between natural
4 gas and mechanical draft on trends seen in the AHRI
5 database from 2007 to 2014. The trend that we
6 observed was that the mechanical draft market was
7 increasing, while the natural draft market was
8 decreasing.

9 DOE assumes that this trend continues
10 beyond the year 2014, and continues throughout the
11 analysis period. DOE observed a similar trend
12 between steam boilers and hot water boilers, where
13 the hot water boiler market is increasing. DOE
14 assumes that this trend also continues throughout the
15 analysis period.

16 DOE saw a similar trend between large
17 boiler models and small boiler models, where the
18 large boiler model market is decreasing, and the
19 small boiler model market is increasing. DOE
20 similarly assumes that this continues throughout the
21 analysis period.

22 DOE calculated price elasticity based on

1 the planned shipments and household economic data
2 during the period 1890, or sorry 1980 through 2002.
3 You can see Appendix 9-A for more details. So this
4 chart shows the results of the shipments analysis,
5 both historical and projected. So from the chart,
6 it's obvious that each equipment cost grows and
7 decays at different rates.

8 So the bottom eight colors are all the
9 natural draft equipment classes. So from this, it's
10 clear that we're showing a decrease in the natural
11 draft market. You can also see that the largest or
12 the single equipment cost with the largest growth is
13 the blue one, the big blue one in the middle, and
14 that's the small mechanical draft hot water gas
15 boiler.

16 You can see that overall, the shipments
17 are pretty flat and don't have much growth over the
18 analysis period.

19 Okay. So DOE has several requests for
20 comments. DOE requests inputs on the shipments
21 projection methodology. DOE invites comments about
22 the selection of appropriate economic drivers, and

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1 the sources of data for historical shipments and
2 shipments breakdowns for high equipment costs.

3 DOE seeks historical commercial boiler
4 shipments data which is aggregated by equipment class
5 and efficiency level, if available. DOE seeks input
6 on the potential impact of amended energy standards
7 on commercial boiler shipments.

8 MR. BROOKMAN: Frank.

9 MR. STANONIK: Frank Stanonik. A couple
10 of immediate comments. As far as the shipment
11 projection methodology, the slide -- the previous
12 slide you talk about, new construction market -- I'm
13 sorry, maybe it was the one before that -- new
14 construction market saturation projected by new
15 buildings, again I think based on what the trends
16 are, it --

17 I'll put it this way. I think an attempt
18 should be made to determine the -- how many boilers
19 get installed per each new building. In other words,
20 you know, if the trend is -- to be totally facetious
21 here, if the trend was that in fact new buildings
22 tend to each have on an average three new boilers

1 installed as a module or whatever, then you know,
2 that obviously would make the shipment, that part of
3 the shipment projection very different.

4 And again, I'm hedging here, because I
5 appreciate the difficulty of getting -- of trying to
6 get some good information. But I think you need to
7 realize that it's possible that in terms of new
8 construction, let's say the boiler shipment -- there
9 should be a boiler shipment multiplier as opposed to
10 one boiler per building. I think that's very
11 possible.

12 The other thing that is questionable, I
13 question is that your price elasticity there, I'm
14 reading -- and I hope I'm wrong, but I'm reading that
15 that basically you're using essentially data from
16 residential boilers to come up with price elasticity
17 for commercial models.

18 If that's the case, and again I appreciate
19 maybe that's the only thing you had. But if that's
20 the case, I'm going to say that's really -- that's
21 not great. That's not very useful, I don't think. I
22 mean again, when you get into commercial boilers, I

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1 think you're dealing with a whole different pricing
2 structure and relationship between the customer and
3 the seller, whoever that might be.

4 I'd be real -- I am real leery about
5 taking any kind of residential data on certainly
6 something like price elasticity, and applying it to
7 commercial boilers. Some of the other stuff we said
8 before, you know. We will certainly try and provide
9 some of this shipment information to the extent that
10 our members can provide it.

11 MR. BROOKMAN: Thank you. Harvey.

12 MR. SACHS: On that Issue 34, there's just
13 some question about the extrapolation from -- I'm
14 sorry, not on 34, the issue of extrapolating from
15 residential elasticity to this product class. I
16 haven't read the whole TSD. There may be
17 justification for it. It's intuitively a little bit
18 perplexing to me.

19 MR. LEKOV: So -- Alex Lekov, LBNL. We
20 believe the analysis need to reflect the fact that
21 there is some impact on the shipments, as a result of
22 increased cost of the highest efficiency level. This is

1 the closest that we have to set of basically
2 relationship.

3 We realize that, and this is the type of
4 comment you guys have been commenting several times.
5 But that's the information that's available right
6 now. If you could comment on it and help to enhance
7 it, that would be great. Thank you.

8 MR. BROOKMAN: Okay.

9 MR. SACHS: I very much appreciate the
10 quandary you're in and I'm just a little bit afraid
11 that downstream, when this gets turned over to the
12 economists, who can be very literal people, they will
13 try to look at \$50 differences in life cycle costs by
14 efficiency level, and think those numbers are real.

15 If we don't have a good metaphor, much
16 less a good model for what elasticity is or so many
17 of these other parameters, I'm just concerned about
18 how we make it clear to those who will use these
19 analyses where the sensitivities are and where the
20 uncertainties are.

21 That's the more general point, and I know
22 you're even more sensitive to that than I am, and

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1 have much better tools than I do for addressing it.

2 MR. BROOKMAN: Do we have any additional
3 comments on this series of requests? Okay.

4 MS. SINGLA: The purpose of the National
5 Impact Analysis is to estimate the national impacts
6 of energy conservation standards for commercial
7 boilers shipped between 2019 and 2048. The impacts
8 on the national energy savings or the NES and the net
9 present value or the NPV were studied in particular.

10 The NES is the primary energy savings. It
11 is the difference between two projections. It is the
12 base-case energy use without new standards
13 projections, and the standards case, that is with new
14 standards-case projection.

15 The NPV is the difference between the
16 present value of energy cost savings, and the present
17 value of total installed-cost increase. The
18 methodology used to calculate the NES and NPV looks
19 at each equipment class at each standards case.

20 For each equipment class in each standards
21 case, the per unit cost increase and the per unit
22 energy savings due to the standards were calculated.

1 The number of units or the stock were also
2 calculated, and the energy savings for each year were
3 calculated from 2019 to 2048. These two parameters
4 were combined in order to determine the NES and the
5 NPV.

6 We'll go over the inputs into the
7 calculations. So as I stated before, the national
8 energy savings is the difference in annual energy
9 savings between the base case and each standards case
10 summed over the analysis period.

11 The inputs into the NES calculation are
12 the annual energy consumption per unit, the
13 shipments, the equipment stock, the national annual
14 energy consumption, the rebound effect, site to
15 source conversion factor and the full-fuel-cycle
16 factor.

17 The net present value is the difference
18 between the present value of energy cost savings and
19 the present value of total installed cost increase.
20 The present value of total installed cost increase is
21 the difference in installed cost between the base
22 case and each standards case, discounted to the

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1 present and summed over the analysis period.

2 The present value of energy cost savings
3 is the difference between operating cost savings
4 between the base case and each standards case from
5 2019 to the time when the last unit installed in 2048
6 is retired.

7 The inputs into the NPV calculation are
8 the total installed cost per unit, the annual per
9 unit savings and operating cost, the shipments, the
10 equipment stock, the total annual increases in
11 installed cost, the total annual operating cost and
12 the discount factor.

13 A key component of the NIA is the
14 efficiency of boilers projected over time to the base
15 case, that is without new standards, and for each of
16 the standards case that is with potential new
17 standards. For each equipment cost, DOE develops a
18 distribution of efficiencies in the base case for the
19 year 2019.

20 In each standards case, DOE assumes a
21 roll-up scenario to establish the efficiency
22 distribution for 2019. Equipment efficiencies in the

1 base case that do not meet the standards case under
2 consideration would roll up to meet the new standard
3 level.

4 All efficiency shares in the base case
5 that are already above the standard under
6 consideration would not be affected. DOE projected
7 efficiency trends after the year 2019 as well. After
8 2019, DOE assumes that the share of market -- that
9 the market share of condensing boilers will increase
10 linearly.

11 Within condensing boilers, the efficiency
12 distribution remains at the same proportions as in
13 2019. The efficiency distribution of non-condensing
14 boilers remains the same after 2019, even though the
15 overall market share of non-condensing boilers
16 decreases.

17 So this chart shows the overall projected
18 growth of the condensing boiler market. This is
19 based on the AHRI Models Directory from 2007 to 2014.
20 We simply just extrapolated it to the year 2049. The
21 condensing market share only applies to four
22 equipment classes. Those are the hot water and

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1 mechanical draft equipment classes.

2 MR. BROOKMAN: Frank.

3 MR. STANONIK: Before you leave
4 that chart.

5 MS. SINGLA: Yes.

6 MR. STANONIK: Frank Stanonik, AHRI.

7 Okay. So we've had a bit of a discussion earlier,
8 that in fact the actual market availability of
9 condensing oil boilers of any size is extremely
10 small, I think, and now how did you get --

11 So in 2019, you're showing, you know, I
12 would say roughly something on the order of eight or
13 nine percent for a small oil and 18-19 percent for
14 large oil. How did you get to that number from where
15 we are today?

16 MS. SINGLA: So this was based on trends
17 in the AHRI Models Directory from 2007 to 2014. So we
18 looked at the growth during that period and projected
19 it forward. We assumed a linear growth.

20 MR. STANONIK: Okay. Then I'm going to --
21 and again, I will research this, but I'm going to
22 venture that whatever trend you saw for the oil

1 condensing products, I would say is not a big enough
2 sample to say it's a trend at this point.

3 And again, I'll go back and check. I'm
4 not, you know, I'm not going to profess that I'm
5 reviewing the status of oil condensing boilers on
6 anything like a regular basis. But to my
7 understanding, those are still pretty rare products.

8 MS. SINGLA: Yeah. We appreciate your
9 comment. We'll take that into consideration.

10 In 2011, DOE announced the use of a full-
11 fuel cycle or FFC metric in the cost-benefit
12 analysis. The methodology is based on the
13 calculation of a full-fuel-cycle multiplier, or a
14 conversion factor, for each of the primary fuels used
15 by the product.

16 For this preliminary analysis, DOE
17 calculated FFC energy savings using a methodology
18 based on the National Energy Modeling System or NEMS.
19 This is described in detail in Appendix 10-B.

20 The primary NES and FFC energy savings for
21 the considered efficiency levels are reported in full
22 in Chapter 10.

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1 So this is the table of the Primary
2 National Energy Savings. There was also in quads,
3 and the results from other states for multiple
4 equipment classes for each considered efficiency
5 level.

6 So the next few tables, the new few slides
7 are just results tables. So this is the -- the next
8 slide is the full-fuel-cycle national energy savings
9 results, with again the results in quads.

10 The next table is the Net Present Value
11 results, with a discount rate of three-percent
12 applied. So note that the negative values are
13 indicated by parentheses. And the last results table
14 is the Net Present Value results, discounted to seven-
15 percent.

16 MR. BROOKMAN: Comments, questions on any
17 of these foregoing tables?

18 (No response.)

19 MR. BROOKMAN: We have a question from
20 Jeff Kleiss. Jeff asks "Is the total annual increase
21 in installed cost inflation, or does it have a
22 broader scope?"

1 MS. SINGLA: The total annual increase
2 is --

3 MR. BROOKMAN: In installed cost
4 inflation, or does it have a broader scope?

5 MS. SINGLA: Based on differences between
6 different equipment classes?

7 MR. BROOKMAN: I'm not sure. Jeff, can
8 you unmute your phone?

9 MR. KLEISS: Yeah. This is Jeff Kleiss
10 from Lochinvar, and this is going back to the Slide
11 91, where you're going through the Net Present Value,
12 and it's the assumption for total annual increase in
13 installed cost, the increase attributable to
14 standard, calculated by vintage.

15 I'm just wondering, is that -- are you
16 just saying that that's the cost increase of
17 installed appliances based on inflation, or are there
18 other factors that are influencing that --

19 MS. SINGLA: Yeah. This is just based on
20 the different efficiency levels. So this right here
21 is actually we take the efficiency weighted total
22 installed increase. So it's the shipment's weighted

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1 efficiency total installed increase. Alex, do you
2 want to clarify that?

3 MR. LEKOV: If I understand -- Alex Lekov,
4 LBNL. If I understand his question, in essence, as
5 she just said, we're accounting for the increased
6 cost of the equipment and the installation cost over
7 the years. It's not inflation rate.

8 MR. BROOKMAN: Okay.

9 MR. KLEISS: Okay. So there's no
10 consideration for, as years ago on, that there might
11 be inflation and that the cost -- the initial
12 installed cost of appliances is going to go up with
13 inflation?

14 MR. LEKOV: This is accounted -- Alex
15 Lekov, LBNL. This is accounted in the discount rate.

16 MR. KLEISS: Okay. Thank you.

17 MR. BROOKMAN: So four tables of a lot of
18 data. Any comments or questions about all of those?
19 Frank.

20 MR. STANONIK: Frank Stanonik. I think I
21 know the answer. I just want to make sure I'm
22 remembering right. So on your savings here, as an

1 example, just in the first row, the savings at
2 Efficiency Level 3, that is the total savings
3 compared to the baseline?

4 MS. SINGLA: Correct.

5 MR. STANONIK: So each one of those is
6 that level compared to the baseline. They're not
7 additive in other words?

8 MS. SINGLA: Correct. Each one compared
9 to the baseline.

10 MR. BROOKMAN: Okay. We're going to move
11 on to Preliminary Manufacturer Analysis.

12 MR. MYERS: This is Frank Myers. I
13 thought we're going to a list of questions. So I was
14 holding my comment. But I think it's probably
15 appropriate to make it now.

16 MR. BROOKMAN: Let's do it. Let's back up
17 to wherever we need to back up to.

18 MR. MYERS: You can go back to the
19 previous slide, although it appears it applies to
20 this section, and that is there appears to me to be a
21 fundamental flaw in the analysis. Not in the
22 details, but in the concept.

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1 It appears, and correct me if I'm wrong,
2 that this analysis is largely based on if you
3 increase the boiler efficiency, there will be a
4 resulting savings, and where you cannot get savings
5 if you don't have the efficiency, having the
6 efficiency does not mean that you're going to have
7 energy savings, and therefore any payback.

8 If for example, the building stock is
9 designed -- the boiler system and the building stock
10 is designed to have a return water temperature of 130
11 degrees or higher, there will be no, zero, nada
12 savings from the application of a condensing boiler
13 of any efficiency, because the boiler cannot
14 condense.

15 So to think that requiring a boiler to be
16 more efficient is therefore going to result in more
17 energy savings is incorrect. In fact, if your return
18 water temperature, the building is not designed for
19 return water temperature of 100 degrees or below,
20 you're only going to have a tiny amount of savings.
21 Now if there are 100 degrees or below yes, you can get
22 good savings from a condensing product.

1 And it's my observation -- now this is
2 anecdotal, based on my experience, that the vast
3 majority of building stock in the U.S. today has a
4 return water temperature of between 140 and 160
5 degrees. And in any of those buildings, if you apply a
6 condensing appliance, there will be zero additional
7 savings.

8 MR. SACHS: Frank, this is Harvey, and I
9 much appreciate the concern, and I think this loops
10 back to the conversation we were having this morning
11 about Tom Durken's published experience with
12 conversion of high temperature systems in schools
13 to low temperature systems in the same buildings,
14 where he reported savings up into, as I recall, 70
15 percent or so as the high end on steamed buildings he
16 converted, and this included all of the retrofit
17 costs, down into the 40 percent range for some decent
18 hot-water systems.

19 So it may be that there are large classes
20 of buildings for which this is not feasible, but I
21 think that the assertion that it's almost never
22 feasible because of the designed-in temperatures,

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1 contradicts some field experience that I will
2 introduce into the record, so it can be criticized
3 and reviewed.

4 MR. MYERS: Excellent.

5 MR. BROOKMAN: Okay. Thank you, Frank.

6 MR. MYERS: Thank you.

7 MR. BROOKMAN: Let's press on. Yes, Alex
8 Lekov.

9 MR. LEKOV: Alex Lekov, LBNL. Just for
10 the record, in fact Frank, DOE's analysis account for
11 the fact that the fraction of installation of
12 condensing boilers were not going to operate in the
13 condensing conditions. So this loss of efficiency is
14 accounted in the analysis. Thank you.

15 MR. BROOKMAN: Okay, thank you.

16 MR. MYERS: This is Frank Myers again. Do
17 you -- does the record include the percentage that
18 you are taking that action on? My sense is that it's
19 the vast majority. So I'm curious as to what
20 percentage was selected.

21 MR. LEKOV: But DOE's life-cycle-cost
22 analysis spreadsheet and the technical support

1 document in Chapter 7 account this information. Of
2 course, you could take the fractions and approach
3 that is described there, and provide comments that
4 could improve DOE's analysis for the next phase.
5 Thank you.

6 MR. MYERS: Thank you. I'll look at
7 Chapter 7.

8 MR. BROOKMAN: Okay, thanks.

9 MR. GLASS: This is Robert Glass with
10 Raypak.

11 MR. BROOKMAN: Yes.

12 MR. GLASS: Just to carry on, one of the
13 things said earlier this morning was that there was
14 changing out the distribution heat transfer surface
15 was not taken into consideration in costs or anything
16 else, but that there was some portion that was taken,
17 realizing that condensing products would not be
18 operating in the condensing zone, and that that was
19 taken into account.

20 But if, as Frank had mentioned, if the
21 final distribution heat condenser surface is not
22 providing it in any type of a retrofit standpoint,

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1 then I also stand by what Frank was saying, is that
2 you're not going to have the savings that is being
3 projected.

4 That even backs up what Harvey was saying,
5 from the standpoint of if a building was retrofitted
6 and completely retrofitted, which means therefore the
7 costs associated with the distribution and the end
8 heat transfer, that needs to be accounted for if these
9 savings that are being projected are going to be
10 realized. Otherwise, what's being projected there
11 will not be realized.

12 MR. BROOKMAN: Okay. Do we have
13 additional comments here before we move onto the
14 preliminary MIA? Okay. We're moving on.
15 Preliminary Manufacturer Impact Analysis

16 MR. ALLEN: Hi. My name's Andrew Allen
17 and I work for Navigant, and I will be presenting the
18 preliminary Manufacturer Impact Analysis. So the
19 Manufacturer Impact Analysis takes into account
20 inputs from the Market and Tech Assessment, as well as
21 the Engineering Analysis and the Shipments Analysis.

22 The purpose of the MIA is to identify

1 potential impacts for amended energy conservation
2 standards on manufacturers of commercial packaged
3 boilers. The analysis is conducted in three phases.
4 In the first phase, DOE creates an industry profile
5 to characterize the industry, that identifies
6 important issues that require consideration.

7 This is primarily what I will be focusing
8 on today, as this is a part of the MIA that DOE
9 conducts in the preliminary analysis stage of the
10 rulemaking process. The bulk of the quantitative
11 analysis is on the second and third phases of the
12 MIA, which take place during the NOPR stage of the
13 rulemaking process.

14 In the second phase, DOE prepares an
15 industry cash flow model and an interview
16 questionnaire to guide subsequent discussions with
17 manufacturers. And in the third phase, DOE interviews
18 manufacturers and assesses the impacts of standards,
19 both quantitatively using the government regulatory
20 impact model and qualitatively, taking into
21 consideration potential impacts of standards on
22 industry competition, manufacturing capacity, direct

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1 employment and regulatory burden.

2 So as I mentioned, in the preliminary
3 analysis stage of rulemakings, the MIA focuses on
4 identifying key issues that require consideration in
5 the analysis going forward. DOE primarily identifies
6 these issues through preliminary interviews with
7 manufacturers. So the first issue that DOE
8 identified is that amended standards and an altered
9 test procedure could require commercial packaged
10 boiler manufacturers to retest all of their models,
11 which could strain laboratory and engineering
12 resources and be financially burdensome.

13 Manufacturers stated that testing is
14 particularly challenging for commercial packaged
15 boilers, because of the large size of most equipment,
16 and the fact that many commercial packaged boilers are
17 custom manufactured.

18 The second issue DOE identified is that
19 not many American manufacturers produce condensing
20 heat exchangers. Therefore, any standard
21 necessitating condensing technology would require
22 manufacturers to either continue to source heat

1 exchangers from overseas, or make investments in
2 product development and capital equipment to create
3 their own production capacity.

4 And so the last key issue DOE identified
5 is that DOE recognizes amended standards could
6 differentially impact small businesses. DOE has
7 preliminarily identified 21 small business
8 manufacturers of commercial packaged boilers, and
9 manufacturers stated that these companies may have
10 fewer engineering, testing and capital resources to
11 adapt to standards, compared to other competitors.

12 In the NOPR stage, DOE will conduct a
13 Regulatory Flexibility Analysis that examines the
14 potential impacts on small entities of amended
15 standards.

16 So this brings us to issues on which DOE
17 is seeking comment. In Issue 31, DOE is requesting
18 comments and information on small business
19 manufacturers, and any information that can help
20 inform the regulatory flexibility analysis.

21 In Issue 32, more generally, DOE is
22 requesting comments on any additional subgroups that

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1 warrant analysis, that may have different cost
2 structures or operate within different regulatory
3 frameworks from the rest of the industry.

4 And finally in Issue 33, DOE is requesting
5 comment on its overall identification of key issues
6 for this rulemaking, and is requesting any additional
7 data or information that will assist it in evaluating
8 the potential impact of amended standards on
9 manufacturers.

10 MR. SACHS: This is Harvey, and I'd like
11 to return to your first item, testing burden. The
12 amended standards and an altered test procedure could
13 require CPB manufacturers to retest all models which
14 could strain lab resources and result in added
15 financial burden.

16 These are issues which have been addressed
17 respectively in the 2013 Negotiated Rulemaking, which
18 included this class of equipment, and in the recent
19 residential hot water heater or water heater
20 standards rulemaking, which involved a very major
21 shift in the paradigm for classifying and rating
22 residential water heaters.

1 On the first issue, there was widespread
2 acceptance, which certainly will have some burdens
3 differentially across manufacturers, of the concept
4 for off-setting, to the extent possible, physical
5 testing in the lab with simulations such as the AEDMs.
6 If we're going to look at this, we need to look at
7 what can be done, what cannot be done with AEDMs.

8 With respect to the second issue, by law
9 DOE was committed to developing the translation
10 engine, to allow for existing products to be given
11 ratings with the new rating method, based on
12 algebraic conversions. We recognize, all of us I
13 think, that this will not be perfect, but we think
14 that there will be minimum disruption in terms of
15 either disqualifying or mis-rating equipment.

16 It's a one-time process, and it depends
17 upon this proceeding going all the way through
18 without or getting a new test method. So I
19 respectfully suggest that this requires using the
20 recent history of DOE rulemakings to think about what
21 it actually means.

22 MR. BROOKMAN: Okay. Now you see the

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1 three comment boxes. Additional thoughts on these?

2 Subgroups, for example, small businesses and others.

3 MR. SACHS: I want to say one other thing

4 on that. This is Harvey. The issue of testing

5 burden on small business is a real one. My father-in-law

6 was a small manufacturer and I'm sensitive to this. The

7 biggest contribution we could make to helping small

8 business survive and thrive would be development of

9 standardized simulation engines, open source that

10 manufacturers could use, rather than each one having

11 to develop its own proprietary information or

12 proprietary model.

13 It need not be a requirement to use the

14 DOE model. Others could be validated. But DOE does

15 have research resources, it does have standards

16 resources, and if we're serious about small business

17 taking your observation of burden and converting that

18 to opportunity for more sophisticated design, it

19 would seem to be well worth doing. End of rant.

20 MR. BROOKMAN: Yeah, thank you. Any

21 additional comments on these three?

22 MR. SACHS: Jim Raba is prescient on

1 that. This is Harvey again. DOE's heat pump model
2 has been very widely used, I'm told, by multiple air
3 conditioner and heat pump manufacturers. This was a
4 model developed at Oak Ridge. I don't care where
5 it's developed, and it's been in use for a couple of
6 decades now, as something of an industry resource
7 that's open to anyone.

8 There's no reason we can't do this much
9 more widely, and I'm quite confident that the
10 manufacturers will discover the defects in any models
11 you develop leading to iterative improvement, just like
12 all other software.

13 MR. BROOKMAN: Okay. No additional comments
14 here?

15 (No responses.)

16 MR. BROOKMAN: Not at this time, okay.

17 Then to Next Steps.

18 Next Steps

19 MS. SINGLA: So the presentations that you
20 have heard today, including the engineering analysis,
21 the life cycle costs, the National Impact Analysis,
22 those are all preliminary analyses. So in the next

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1 phase, in the Notice of Proposed Rulemaking or the
2 NOPR, we will revise all of those preliminary
3 analyses.

4 In addition to that, DOE will also perform
5 a series of new analyses. The new analyses that DOE
6 will perform in the NOPR phase include the Consumer
7 Subgroup Analysis, the Manufacturer Impact Analysis
8 and Emission Impact Analysis, Utility Impact Analysis,
9 Indirect Employment Analysis and the Regulatory
10 Impact Analysis.

11 In the preliminary analysis phase, we
12 developed results from multiple efficiency levels for
13 each equipment class. In the NOPR analysis,
14 efficiency levels from each equipment class are
15 grouped together to create trial standard levels or
16 TSLs. The TSLs represent potential new standards.

17 Each TSL consists of a set of efficiency
18 levels covering all product classes, and may vary
19 between product classes. The NOPR analysis assesses
20 impacts for TSLs, not for efficiency levels. DOE
21 applies the methodology to assemble the TSLs.

22 Some possible criteria that could be used

1 to determine the TSLs include most energy efficient
2 level, efficiency level with the lowest life-cycle
3 cost, efficiency level with a payback period of three
4 years or less, efficiency levels with noteworthy
5 technologies, and efficiency levels that fill in
6 large gaps.

7 MR. BROOKMAN: So DOE requests feedback on the
8 criteria that it should use for basing this selection of the
9 TSLs. Thoughts on this?

10 MR. STANONIK: Frank Stanonik, AHRI. A
11 kind of immediate comment, and admittedly a bit of a
12 generalization. But I think because we're talking
13 commercial boilers and the fact that it's a very
14 mature product, I think that your selection of trial
15 standard levels should have a significant basis of, in
16 fact, models that are available on the market today.

17 I think in most -- I'm trying to remember
18 what I saw much earlier on one of the slides. I
19 think, you know, most of the levels being discussed,
20 there are probably one or two or three models
21 available at those levels. If not, then maybe it's
22 not a level to look at.

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1 But I think there should be, in this case,
2 significant correlation between models available on
3 the market today and the trial standard levels you
4 look at, excluding max tech.

5 MR. BROOKMAN: Okay. Thanks, Frank.

6 MS. SINGLA: So one of the additional
7 analyses that DOE will conduct in another phase is
8 the consumer subgroup analysis. The purpose of the
9 consumer subgroup analysis is to analyze the economic
10 impacts of standards on commercial consumers,
11 including subgroups who may be disproportionately
12 impacted compared with the general use population.

13 DOE determines the consumer subgroups
14 impacted by modifying the SEC analysis to examine the
15 impacts for defining subgroups. So DOE requests any
16 input as to which consumer subgroups, if any, it
17 should consider when developing standards for
18 commercial buildings.

19 (No response.)

20 MS. SINGLA: So we'll talk about the
21 remaining additional analysis that DOE will perform
22 in the NOPR phase. In the NOPR phase, DOE will

1 perform an emissions impact analysis. The purpose of
2 the analysis is to estimate the emissions impacts
3 from amended energy conservation standards.

4 DOE uses the full fuel cycle energy
5 savings, which were determined in the NIA, together
6 with the emissions factors from AEO, in order to
7 estimate the emissions reduction as a result of
8 savings, I'm sorry, as a result of standards.

9 DOE estimates the reduction in common
10 sector, common site combustion emissions of carbon
11 dioxide, nitrogen oxides, sulfur dioxide, mercury,
12 methane, and nitrous oxide. DOE considers the
13 estimated mandatory benefits that could be the result
14 of reduced emissions of CO2 from the energy standards.

15 To estimate benefits from CO2, benefits
16 plans to use the social costs of carbon values, which
17 were developed by an inter-agency process. So DOE
18 requests any information or requests comments about
19 emissions and also an emission monetization
20 analysis, and you can see the specific questions on
21 the slide.

22 MR. BROOKMAN: And particularly if there

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1 are any other approaches that DOE should consider.

2 MS. SINGLA: In the NOPR, DOE will perform
3 a utility impact analysis. The purpose of this
4 analysis is to assess the overall impacts on domestic
5 energy supplies that would result from the standard.
6 The utility impact analysis is performed by taking
7 the national energy savings results from the NIA and
8 applying them in the National Energy Modeling System
9 or NEMS.

10 The output of NEMS includes the change in
11 energy sales and prices by region, the mix of energy
12 generation and the change in new electricity capacity
13 generation. The utility impact analysis reports the
14 change in new generation capacity. DOE seeks input
15 about its plans to use NEMS to conduct the utility
16 impact analysis.

17 (No response.)

18 MS. SINGLA: Another analysis that DOE
19 will perform in the NOPR phase in the indirect
20 employment analysis. The direct employment analysis
21 was already discussed a little while earlier in the
22 manufacturers impact analysis. Here, we are talking

1 about the indirect employment analysis.

2 The purpose of this analysis is to report
3 the net jobs created or eliminated nationally as a
4 consequence of new energy conservation standards.

5 The impact analysis uses the IMSET tool, which is a
6 spreadsheet model of the U.S. economy that focuses on
7 the sectors most relevant to building energy use.

8 Changes in product and energy expenditures
9 are taken from the MIA. The outputs of this analysis
10 is the change in employment by sector as a
11 consequence of new standards. DOE requests comments
12 about its planned approach for assessing national
13 indirect employment impacts.

14 (No response.)

15 MS. SINGLA: The final analysis that DOE
16 will perform in the NOPR phase is the regulatory
17 impact analysis. The purpose of this analysis is to
18 investigate the national impacts due to
19 non-regulatory alternatives, compared with mandatory
20 energy conservation standards.

21 The non-regulatory alternatives that may
22 be considered include no new regulatory action, early

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1 replacement, prescriptive standards, consumer tax
2 credits, manufacturer tax credits, consumer rebates,
3 voluntary efficiency targets and bulk government
4 procurement.

5 The regulatory impact analysis was
6 performed by modifying the NIA spreadsheet to
7 consider non-regulatory scenarios. The
8 non-regulatory scenarios increase overall plant
9 efficiency modeled by modifying the base case
10 efficiency trend.

11 The NPV is calculated by non-regulatory
12 alternatives, in the same way as for the adopted
13 standard. The output of this analysis is the
14 national energy savings and net present value of the
15 non-regulatory alternatives.

16 MR. BROOKMAN: Jeff Kleiss wishes to make
17 a comment or ask a question. Jeff, please go ahead.

18 MR. KLEISS: Actually, I realize that the
19 context was wrong, and I don't have anything to add.

20 MR. BROOKMAN: Okay, thank you. So
21 regulatory impact analysis. There you see the
22 description. Questions and comments on what's

1 presented here? Yes, Frank Stanonik.

2 MR. STANONIK: Frank Stanonik, AHRI. I
3 guess I'm trying to make sure I understand this
4 process, because actually this last slide puzzled me
5 a little bit. So going back to the schedule in, I
6 think it's roughly June or July, officially DOE is
7 supposed to determine whether they are going to --
8 whether a change is appropriate in the standards or
9 not.

10 And, maybe I'm getting residential and
11 commercial mixed up, and my recollection is that if
12 they decide a change is required, they issue a NOPR
13 at that time. And why are we talking about DOE
14 issuing a NOPR? So I'm really a little bit -- I'm no
15 understanding why, and I appreciate it. But why
16 would they be looking at non-regulatory alternatives,
17 when it seems to me there's at least, if not a
18 decision, a strong leaning towards having a next, you
19 know, a next level of new standards? I'm missing
20 something, I think.

21 (Off mic comment.)

22 MR. STAS: Eric Stas, DOE. Well, you

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1 know, if look back in the regulatory analyses which
2 follow any of these rulemakings, this is one of the
3 requirements. I think it's under Executive Order
4 12866, that there has to be an analysis of
5 non-regulatory alternatives.

6 That goes into the RIA document, which I
7 think is put in the docket along with the TSD. So
8 this is the very standard theme print that you
9 actually see all the time. So this is nothing new.
10 It's just part of the normal, the normal process.

11 And you know, one of the things that you
12 have to look at is no action, but clearly EPCA is
13 directing us to take action to analyze these things,
14 and to do no action only if it's a no standard
15 standard kind of situation, which sometimes happens
16 but isn't typically the case.

17 MR. STANONIK: But so this part of the
18 analysis will be in the NOPR package?

19 MR. STAS: Yes. It's typically there
20 every time.

21 MR. BROOKMAN: Final comments on this
22 series of analyses that will occur downstream in the

1 NOPR phase? All right, okay. So then now, as we
2 promised first thing this morning, is another
3 opportunity for comment. Anybody that wishes to make
4 comments here as we move towards closure, issues that
5 you wish to bring to the floor that haven't been
6 covered sufficiently. Concluding remarks.

7 MR. MYERS: This is Frank Myers. Could
8 you roll back to the previous slide please?

9 MR. BROOKMAN: 115?

10 MR. MYERS: Yes.

11 MR. BROOKMAN: Uh-huh.

12 MR. MYERS: Something that -- this might
13 be statutory, and if so, I apologize, in terms of the
14 things that may be considered. But one
15 non-regulatory alternative that might be considered
16 is to look at ASHRAE 90.1 and create some kind of
17 requirement that new buildings or renovated buildings
18 have to put in systems that can utilize condensing
19 equipment.

20 There's lots of condensing equipment out
21 right now and the biggest holdback from more of it
22 being applied is not a regulation saying you have to

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1 have it. It's that wed like to have more buildings that
2 can use it.

3 So that might be something to look at as a
4 non-regulatory alternative, would be some form of
5 requirement, based on positive payback, that might
6 well be seen to for new buildings, and potentially
7 for modified buildings, to require them to have low
8 return water temperatures so the benefit of
9 condensing boilers can be enjoyed.

10 That would tremendously increase the
11 application of condensing equipment.

12 MR. BROOKMAN: Okay, thank you.

13 MR. SACHS: This is Harvey. Of course
14 Frank, that is a regulatory but non-standards
15 approach, in that the 90.1 would be adopted into code
16 by the jurisdictions authorities.

17 MR. MYERS: True enough.

18 MR. SACHS: Pardon me?

19 MR. MYERS: True enough. I say you're absolutely
20 correct. I was thinking about a DOE efficiency
21 regulation. This would be an alternative to that.
22 But it is in fact quasi-regulatory.

1 MR. SACHS: You would certainly find the
2 advocates strongly supportive of that, and working
3 with y'all on anything we could do. Again, Durkin
4 has a small sample of 20 schools that he published,
5 ten steam, ten high-temperature hot water.

6 But minimum savings were still somewhere
7 in the range of 40 percent for doing those system
8 changeouts, and that's very, very large in the
9 context of what we can achieve with standards alone.

10 MR. BROOKMAN: Thank you. Jeff Kleiss,
11 unmute your phone. Let's hear from you.

12 MR. KLEISS: Alright, two things. One, I
13 wanted to say thanks to DOE for the exclusion of
14 looking at standby electrical power consumption. I
15 think that's very reasonable, and considering the vast
16 majority of the power consumption that's being used
17 on these products. I appreciate that.

18 The other thing is when you're -- I
19 overlooked stating this before. When you're doing
20 your cost analysis for products, as -- if there is
21 any consideration of altogether eliminating
22 condensing appliances, there are --

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1 Because so many of the heat exchangers for
2 condensing appliances are purchased, particularly
3 from overseas, that it will affect many
4 manufacturers, the overhead structure that they have,
5 and increase the cost of all their remaining
6 products, because there's going to be a lot of
7 overhead and equipment that has been used to produce
8 non-condensing heat exchangers, that will now become
9 idle, and that cost will have to be absorbed in the
10 remaining products.

11 MR. BROOKMAN: Okay, Jeff. Thank you.
12 Closing remarks, additional final comments?

13 MR. GLASS: This is Robert Glass with
14 Raypak. One of the concerns that I again want to go
15 ahead and mention it here is still related to what is
16 being projected as the estimated lifetime for
17 condensing boilers.

18 I don't know if it's possible to go
19 through the process, but I've heard there were some
20 comments and feedback from the field in regards to a
21 15-year being more representative of condensing
22 products. I don't know if it's possible to also do

1 some of these analyses using 15 years.

2 So that you could say that okay, if it was
3 between 15 or it was between 25 or something in
4 there, you'd have an opportunity to see really what
5 is realistic, what is the payback, what is the life-
6 cycle cost associated with using condensing products.

7 I think it would be very eye-opening, and
8 I think that just leaving it at the 24.8 that's
9 currently in there is going to be adversely affecting
10 some of the decisions that are made, because in
11 reality, we don't know what it is.

12 But I think manufacturers that produce
13 condensing products all feel that the life of the
14 condensing product is going to be substantially
15 shorter than the 24.8 years that's been identified
16 today.

17 MR. BROOKMAN: Alex Lekov.

18 MR. LEKOV: Alex Lekov, LBNL. So in regards to
19 this
20 question about the differences in the
21 lifetime between condensing and non-condensing
22 equipment, DOE will consider any data that could be

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1 provided. At a minimum, DOE will perform scenarios
2 based on their proposal of it, which will show the
3 economic results as an outcome of different
4 lifetimes.

5 MR. GLASS: Well, one of the things that
6 goes along to support that is that there is currently
7 no requirements for any annual maintenance on boilers.
8 Where in Europe, particularly in the UK, there are
9 requirements for annual maintenance of product before
10 the gas company will even turn on the boiler in the
11 wintertime.

12 If that were something that somehow were
13 legislated into place, then I think that would
14 enhance the lifetime of condensing products. But
15 without that requirement, the lifetime of condensing
16 products is going to be substantially less than that
17 24.8 that's been presented.

18 MR. BROOKMAN: Okay, thank you.

19 MR. SACHS: This is Harvey, and I
20 certainly second the spirit of Mr. Glass' remarks,
21 that we should be looking at international
22 experience, not only with respect to maintenance,

1 maintenance contracts, and perhaps better estimates of
2 equipment life, but also in terms of incremental
3 costs, where condensing boilers are a much larger
4 fraction of the market.

5 This is a mature product class. We do
6 find -- well, we have often saluted industry on its
7 incredible ingenuity in finding ways to ring-out costs
8 as competition increases, and I think we have stated
9 for years that looking at international comparisons
10 is important, and would encourage the Department in
11 that direction.

12 MR. BROOKMAN: Okay. Frank.

13 MR. STANONIK: Frank Stanonik, AHRI. Not,
14 because I think I guess then we're kind of winding
15 down here. So I'm going to admittedly belabor a
16 point, because to us, it is important, and that is
17 that as this thing goes forward, we certainly
18 strongly believe that we need to have the test
19 procedure finalized, and the determination about
20 natural draft boilers finalized before this
21 rulemaking on the standards gets too far ahead of
22 those.

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1 I think as we talked about, and it
2 certainly seems to me those things need to be --
3 ideally would be known to all as final or close to
4 final before we see the NOPR on this. That would be
5 thus very important to properly addressing and
6 responding to the NOPR on the standard.

7 MR. SACHS: Frank, you hit one of my hot
8 buttons. This is Harvey, and I've worked on
9 standards committees at ASHRAE, I've worked on standards
10 committees at AHRI. In this particular area, we have
11 had a need that has been recognized for two decades,
12 for a vision cycle today which the AHRI side, which
13 you said is not going to give us things that we've
14 long identified as needed.

15 I don't know whether I'm going to pull out
16 the two remaining hairs on my head, or make an
17 exception to my usual stance, and say that DOE may
18 have to intervene to get something in a timely
19 manner, that ASHRAE and AHRI have simply been unable
20 to move the ball.

21 MR. STANONIK: Frank Stanonik. Harvey, I
22 appreciate your comments, and obviously we have

1 perhaps different thoughts on what the test procedure
2 at this stage should contain. But I think the key
3 point of my comment is when you get to trying to
4 really addressing this next level of standard, we
5 need to know what the test procedure will be, and
6 whether it's Harvey's version or Frank's version, we
7 need to know.

8 MR. SACHS: Do we have a deal for you.

9 (Laughter.)

10 MR. BROOKMAN: Okay. Then I think we will
11 address the next slide. So for my part, I thank all
12 of you. We had a very productive day, and I'll turn
13 it back to Jim Raba.

14 MR. RABA: We conclude today's public
15 meeting with expressed appreciation from the U.S.
16 Department of Energy, it's for your participation,
17 both here live and the webinar. Thank you very much.
18 A very productive meeting, thank you. Very
19 productive, and informative.

20 We also thank our presenters, Rohit, Rupam
21 and Andrew, our facilitator Doug Brookman, and technical
22 crew backstage, Emily this morning and now Alex this

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1 afternoon. Thank you very much. You made this
2 technically possible.

3 We look forward then to receiving your
4 written comments. Heard many comments here. I'd
5 like to see them in writing please and with data and
6 information most of all, and safe travels all. Thank
7 you very much.

8 (Whereupon, at 3:02 p.m., the meeting was
9 concluded.)

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<p style="text-align: center;">A</p> <p>a.m 5:2</p> <p>abilities 54:6 101:13</p> <p>ability 97:17</p> <p>able 10:13 59:18 86:12,12 96:9 104:12 107:22 123:12 136:7 139:6 140:4 153:11 159:22 165:3,22</p> <p>ABMA 52:6 64:18 64:21 65:6 68:9</p> <p>ABMA's 65:20</p> <p>absolute 42:4</p> <p>absolutely 16:9 34:1 108:22 131:8 204:19</p> <p>absorbed 206:9</p> <p>AC 37:8</p> <p>ACCA 75:8</p> <p>accelerated 121:22 122:6</p> <p>accept 95:1 151:22</p> <p>acceptable 160:19</p> <p>acceptance 191:2</p> <p>access 157:17</p> <p>accommodate 120:9</p> <p>account 52:12 74:2 75:20,21 78:14 86:17 117:2 119:9 120:16 122:16 184:10 185:1,19 186:19</p> <p>accounted 118:18 143:9 166:1 180:14,15 184:14 186:8</p> <p>accounting 180:5</p> <p>accounts 77:20 78:4 78:9 89:9,18 91:7 91:15 164:8</p> <p>achieve 205:9</p> <p>acronyms 38:20</p> <p>act 13:1,3 31:6</p> <p>action 184:18 199:22 202:12,13 202:14</p> <p>active 19:17</p> <p>activities 16:6</p> <p>activity 30:13 113:16</p> <p>acts 12:21 13:6</p> <p>actual 63:15 69:19 88:19,20 94:8 126:16 152:5</p>	<p>157:17 176:8</p> <p>Adam 2:10 6:13 7:12 39:9,10 40:7 41:9 42:7,8,18 49:20,22 64:8 67:10,11 70:7</p> <p>Adam's 52:18</p> <p>adapt 189:11</p> <p>add 42:17 51:16 68:17 110:14 118:4 159:12 200:19</p> <p>added 56:7,9 190:14</p> <p>adders 110:13</p> <p>adding 125:15</p> <p>addition 90:2 106:17 108:13 194:4</p> <p>additional 17:5,14 27:5,6 28:2 32:8 50:11 55:15 56:7 56:9 59:12 61:8 75:18 78:18 82:5 83:8,9 100:8 101:22 104:2 119:19 120:7 124:16,19 128:1 129:4 130:6 140:16 144:14 148:9 162:10 172:2 183:6 186:13 189:22 190:6 192:1,21 193:13 196:6,21 206:12</p> <p>additive 181:7</p> <p>address 5:17,20 6:4 12:9 15:16 22:14 96:13 122:11 158:15 160:1 211:11</p> <p>addressed 15:9,12 30:3 190:16</p> <p>addressing 19:7 45:5 60:8,10 172:1 210:5 211:4</p> <p>adds 54:7,8,19 100:18</p> <p>adjust 86:16,22 99:17</p> <p>adjusted 87:13 90:5 90:8</p> <p>adjustment 86:14 86:15 87:8</p> <p>adjustments 87:11</p>	<p>100:2</p> <p>Administration 84:5</p> <p>admittedly 195:11 209:15</p> <p>adopted 200:12 204:15</p> <p>advance 17:3</p> <p>advanced 37:15</p> <p>advances 37:17</p> <p>advent 44:15</p> <p>adverse 35:4,15</p> <p>adversely 207:9</p> <p>advocates 205:2</p> <p>AEDM 22:16</p> <p>AEDMs 22:10 191:5,7</p> <p>AEMTCA 13:6</p> <p>AEO 155:18 165:20 197:6</p> <p>affect 53:15 206:3</p> <p>affiliation 7:2</p> <p>afraid 171:10</p> <p>after-market 99:13</p> <p>afternoon 212:1</p> <p>age 84:22 148:12</p> <p>agency 139:13</p> <p>agenda 8:12,14</p> <p>aggregated 168:4</p> <p>aggressive 32:5</p> <p>ago 25:17 31:21 34:13 39:16 49:1 53:20 54:4 107:8 114:6 150:9 159:9 160:17 180:10</p> <p>agree 16:21,21 26:21 27:2 126:22</p> <p>agreement 83:4</p> <p>ahead 21:17 33:9 67:10 81:16 107:3 108:7 114:11 135:22 141:15 200:17 206:15 209:21</p> <p>AHRI 16:2 25:14 29:2,17,18 30:18 31:18 32:10 41:5 59:20 63:7 78:2 85:15,15 86:4 88:6 91:3 100:9 105:14 108:16 109:17 114:13 140:18 149:22 157:21 158:11,22 161:13 165:8 166:4 175:19</p>	<p>176:6,17 195:10 201:2 209:13 210:10,12,19</p> <p>air 2:6 7:8 10:6 23:12,19 75:3,7 130:22 131:1,21 193:2</p> <p>air-atomized 24:20</p> <p>Alex 2:17 6:13 7:22 78:6 122:11,12 170:19 180:1,3,14 184:7,9 207:17,18 211:22</p> <p>algebraic 191:12</p> <p>Allen 2:21 6:13 7:20 7:20 186:16,16</p> <p>allow 119:7 191:10</p> <p>allowable 22:3</p> <p>allowing 78:13</p> <p>Alright 205:12</p> <p>altered 188:8 190:12</p> <p>alternating 95:12</p> <p>alternative 22:17,20 203:15 204:4,21</p> <p>alternatives 199:19 199:21 200:12,15 201:16 202:5</p> <p>altogether 205:21</p> <p>amended 13:6 116:10 168:6 187:1 188:8 189:5 189:14 190:8,12 197:3</p> <p>America 75:7</p> <p>American 2:19 3:4 7:10 45:3 188:19</p> <p>amount 46:8 116:19 126:11 141:21 182:20</p> <p>analogous 49:7</p> <p>analyses 5:21,22 9:7 63:16,18 67:12 141:18 171:19 193:22 194:3,5,5 196:7 202:1,22 207:1</p> <p>analysis 1:3 4:8,10 5:7,18,19 9:1,2,11 9:11,14 11:12 12:16 14:14,21 15:4,7,10,12,13 15:15,17,19 17:4 17:9,17,20 19:22 23:6 26:22 27:2 27:14 28:19 34:20</p>	<p>34:21 36:16,17,20 36:21,22 37:1,1,3 37:6,9 38:1 43:6 43:17 44:7 45:17 55:19 57:21 58:20 58:21 59:4,11,14 60:1 61:3 63:9 66:5 67:13 69:4 72:8,16,18,19 73:1,6,7,10 74:12 74:14,21 75:8 76:2 79:19 84:4,9 84:10 87:21 88:2 89:5,18 91:7,21 105:19 106:8,18 113:16 114:21,22 116:8,9,10 117:2 117:2,7,8,13 118:17 124:1 125:7 126:21 132:10 143:10 145:2,9 148:11 154:22 156:7,11 156:21 160:3 162:11,14,17,18 162:22 163:2,4,4 163:5,6,7,18,19 164:2 165:9 166:3 166:11,15,21 167:4,18 170:20 172:5 173:10 174:1 177:12,16 181:11,21 182:2 184:10,14,22 185:4 186:15,18 186:19,21,21 187:3,9,11 188:3 188:5 189:13,20 190:1 193:20,21 194:7,7,8,8,9,10 194:11,13,19 196:8,9,14,21 197:1,2,20 198:3 198:4,6,13,16,18 198:20,20,22 199:1,2,5,9,15,17 199:17 200:5,13 200:21 202:4,18 205:20</p> <p>analyze 196:9 202:13</p> <p>analyzed 20:14</p> <p>analyzing 39:16 40:16 52:14</p> <p>and/or 12:7 25:6</p> <p>Andhare 2:8 6:13</p>
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