

Date: March 27, 2015

Case: The Energy Conservation Standards For Residential Furnaces



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U.S. DEPARTMENT OF ENERGY PUBLIC MEETING
THE ENERGY CONSERVATION STANDARDS FOR
RESIDENTIAL FURNACES

U.S. Department of Energy
1000 Independence Ave. SW
Washington, DC 20585
Room No. 8E-089

Friday, March 27, 2015

9:00 A.M.

1 Appearances for Department of Energy Meeting

2

3 John Cymbalsky, DOE

4 Ashley Armstrong, DOE

5 Dan Cohen, DOE

6 Eric Stas, DOE

7 Michael Kido, DOE

8 Francine Pinto, DOE

9 Johanna Hariharan, DOE

10 Doug Brookman, Public Solutions, -- Moderator

11 Timothy Ballo, Attorney, EarthJustice

12 Donald M. Brundage, Southern Company

13 Adam Darlington, Navigant

14 Andrew deLaski, ASAP

15 S. Craig Drumheller, NAHB

16 Rachel Feinstein, HPBA

17 Victor Franco, Lawrence Berkeley National Laboratory

18 John Hodges, Wiley Rein

19 Diane M. Jacobs, Rheem

20 Rebecca Kern, Bloomberg

21 Jeff Kleiss, Lochinvar

22 Sue Kristjansson, Sempra

1 APPEARANCES (CONTINUED:)

2

3 Daniel Lapato, American Public Gas Association

4 Neil P. Leslie, GTI

5 Frank V. Maisano, PRG

6 Michael J. McCabe

7 Samuel McClive, Navigant

8 Charles McCrudden, ACCA

9 Caroline McLean, AGL Resources

10 Sarah A. Medepalli, ICF International

11 Jonathan Melchi, HARDI

12 Karen Meyers, Rheem

13 William T. Miller, McCarter & English

14 Michael Rivest, Navigant

15 Steven J. Rosenstock, Edison Electric Institute

16 Aniruddh Roy, Goodman

17 Robin Roy, NRDC

18 Harvey Sachs, ACEEE

19 Dave Schryver, American Public Gas Association

20 Amy Shepherd, AHRI

21 Frank Stanonik, AHRI

22 Rusty Tharp, Goodman

1 APPEARANCES (CONTINUED:)

2

3 James T. VerShaw, Ingersoll Rand

4 Peeter Vesik, ECCO

5 Charles R. White, PHCC

6 Dave Winningham, ALLIED Air Enterprises

7 Kathryn Clay, American Gas Association

8 Rosalyn Cochrane, NRCAN

9 Chuck Foster, EEI

10 Marshall Hunt, PG & E

11 Mark Krebs, LACLEDE Group

12 Douglas Rathbun, DOJ-ATR

13 Gregory Rosenquist, LBNL

14 David Schroeder

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

2 (9:09 a.m.)

3 MR. BROOKMAN: Okay please take your seats
4 we are going to begin. Good morning, everyone. Welcome.
5 Nice to see you here on a rainy day in Washington,
6 D.C. This is an Energy Conservation Standards
7 Workshop, a Notice of Proposed Rulemaking Meeting for
8 Furnaces. Today is March 27, 2015 here in the
9 Forrestal Building in Washington. Glad to have you
10 here this morning, nice to see such a nice turn out.

11 My name is Doug Brookman, Public Solutions,
12 Baltimore. We are going to start this morning
13 immediately with introductions. So looking to my
14 immediate left, and we can get used to turning the
15 microphones on and off, name and organizational
16 affiliation.

17 MR. MILLER: William Miller, General
18 Counsel for the American Public Gas Association.

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

21 MR. VERSHAW: Jim VerShaw, Ingersoll Rand.

22 MR. WHITE: Chuck White, former contractor

1 working for the Plumbing, Heating and Cooling
2 Contractors Association.

3 MR. MEYERS: Karen Meyers, Rheem.

4 MR. SCHROEDER: Dave Schroeder, consultant
5 with GTI.

6 MR. LESLIE: Neil Leslie, Gas Technology
7 Institute.

8 MR. HODGES: John Hodges, Wiley Rein for
9 the National Propane Gas Association.

10 MR. KREBS: Mark Krebs, the Laclede Group.

11 MR. WINNINGHAM: Dave Winningham, Allied
12 Air.

13 MR. SCHRYVER: Dave Schryver, American
14 Public Gas Association.

15 MS. MCLEAN: Caroline McLean, AGL
16 Resources.

17 MR. ROSENSTOCK: Steve Rosenstock, Edison
18 Electric Institute.

19 MR. HUNT: Marshall Hunt, Pacific Gas and
20 Electric.

21 MR. SACHS: Harvey Sachs, American Council
22 for an Energy Efficient Economy.

1 MS. CLAY: Kathryn Clay, American Gas
2 Association.

3 MR. ROY: Robin Roy, Natural Resources
4 Defense Council.

5 MR. COHEN: Dan Cohen, General Counsel's
6 Office, DOE.

7 MS. ARMSTRONG: Ashley Armstrong, DOE.

8 MR. CYMBALSKY: John Cymbalsky, DOE.

9 MR. LAU: Christopher Lau, Navigant.

10 MS. PINTO: Francine Pinto, General
11 Counsel's Office.

12 MS. HARIHARAN: Johanna Hariharan, General
13 Counsel's Office.

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

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

18 MR. ROSENQUIST: Greg Rosenquist, Lawrence
19 Berkeley National Laboratory.

20 MR. DARLINGTON: Adam Darlington,
21 Navigant.

22 MR. BROOKMAN: And we'd like to have

1 introductions from everyone else as well, starting
2 with Mike Rivest. Just say your name out loud. As a
3 matter of courtesy, I think we should all introduce
4 ourselves. This will not be recorded, just stand and
5 say your name please.

6 (Introductions off mic)

7 MR. BROOKMAN: Okay well thank you and
8 welcome again, nice to see you here for an early
9 start on the day. All of you I hope received a
10 packet of information that will be our principal
11 resource for both presentation and comment and
12 organization as we go through the meeting today. If
13 you look on slide 7 in your packet, there is kind of a
14 general agenda. Immediately following this agenda
15 review are some preliminary slides on the purpose of
16 the meeting, regulatory history and the like. There is
17 an opportunity for opening remarks, brief summary
18 comments here at the outset, hopefully nothing too
19 terribly extensive at the opening but brief opening
20 remarks from anybody that wishes to do so.

21 Moving on from there we will have some
22 overview slides and from there engineering analysis,

1 and then we will take a break mid-morning around
2 10:30 or so. Whenever we get to the break, we will take
3 it; probably around about life-cycle cost
4 analysis and subgroup analysis; somewhere in there.

5 We will then proceed with the shipments model,
6 NIA, and RIA. We will take lunch midday around about
7 noon and then MIA, environmental, employment, and
8 additional research, and then at the end of the day,
9 closing remarks, another opportunity for anybody that
10 wishes to make statements.

11 This is your opportunity for comment to
12 make sure everything you need to say gets covered
13 during the course of the day today; so that's yet
14 another opportunity for you to comment at the end of
15 the day, okay?

16 We are going to have some introductory
17 slides and hear from John
18 Cymbalsky.

19 MR. CYMBALSKY: Thank you Doug; welcome
20 everyone. I'm glad to see such a big turnout for
21 this very important rule. We have been at this rule
22 for a little bit. Just to give a little history on what

1 we have done up until this point: So back in September
2 we released the analytical tools and a bunch of data
3 that supported the numbers you see today in the
4 proposal. We had a public meeting to increase the
5 transparency of what we do in our analytical tools to
6 show stakeholders how to use those tools, and I have
7 to say, that meeting to me was very successful because
8 the comments and the questions that we received ahead
9 of this meeting, to me prove that that meeting was
10 useful because whoever submitted the questions
11 through AGA and APGA I think did a great job of
12 understanding the spreadsheets and asking some very
13 key questions.

14 Those questions helped us actually frame
15 our presentation today, so as we go through, we are
16 going to do our best to flag these questions in the
17 presentation, and I would ask those who submitted
18 questions ahead of time to please make sure that when
19 we are on that slide and we flag it that we answer your
20 question
21 because clearly that is what we want to do here; we
22 want to answer everybody's questions to the best of

1 our ability here.

2 Some of the questions you know related to
3 how this rule is different than the 2011 DFR
4 [direct final rule]; we are going to show as much data
5 and comparison as we can with that.

6 For example, the furnace fan rule that was
7 finalized last summer comes into play here because
8 the performance of an X13 motor essentially will be
9 in a baseline furnace come 2021 when this rule would
10 need compliance. So things like that have a lot to
11 do with the changes in the numbers and such, and we
12 are going to go through all of that data as we go
13 through the meeting.

14 We also met over the past few years; we
15 have had lots of ex parte meetings with lots of
16 different stakeholders. Again, the transparency issues
17 that I think we have addressed here today were
18 brought up. Very complicated issues with this rule
19 including installation cost, venting issues, fuel
20 switching, and so based on that really good public
21 comment, we actually, I think, did a great job in
22 building models and analysis to deal with these very

1 important issues for this product.

2 And so we are going to go through them
3 today. We know AGA and others have done their own
4 analysis; we are going to compare what we did with
5 what you all did to try to understand those key
6 differences as we go through.

7 And then I would just like to add, and I
8 know that there are remarks by AGA and APGA, you know, that
9 talk
10 about efficiency and how important it is to both them
11 and DOE. I'm happy to say in our research we found
12 over 50 different gas utilities offering rebate
13 programs to advance condensing furnaces into homes.

14 There's over 150 different unique programs
15 across the country that are doing this, and so we feel
16 we are partnered in advancing energy efficiency, and
17 we are happy that utilities and other organizations
18 are pursuing the same goals as us, and so with that
19 let's turn it over to opening remarks from whoever.
20 I know we have received a few ahead of time, and I'm
21 sure there're others, so we will pass it off.

22 MR. BROOKMAN: There's one more small bit

1 of preliminary business. I would ask for your
2 consideration. Please speak one at a time and say
3 your name for the record as you need to. There will
4 be a complete transcript of this meeting made
5 available, so I think you know, if you could, share the
6 air time and be concise.

7 If you haven't turned your cell phones on
8 silent mode, please do so, and webinar participants we
9 welcome you. The Department of Energy is trying hard
10 to make these meetings totally accessible via the
11 web. Please leave your telephone on mute so we don't
12 get feedback here in the room, and raise your hand to
13 participate in this conversation here. We will
14 unmute you. We should be able to hear you, and you
15 can join in the conversation in real time.

16 So now let's proceed with opening remarks.
17 I have received a request to let Dave Schryver go
18 first. Microphone on?

19 MR. SCHRYVER: Okay, thank you. My name is
20 Dave Schryver, I am the Executive Vice President of
21 the American Public Gas Association. We appreciate
22 this opportunity to make this brief opening

1 statement. APGA submitted its complete preliminary
2 comments to DOE a week ago, and we request that those
3 comments, including the questions appended thereto, be
4 asserted into this record of this proceeding.

5 My opening statement will simply highlight
6 some of the points made in those comments. APGA is
7 the national association for publicly-owned natural
8 gas distribution systems. There are approximately
9 1,000 public gas systems in 37 States, and over 700 of
10 those systems are APGA members. Publicly-owned gas
11 systems are not-for-profit, retail distribution
12 entities owned by and accountable to the citizens
13 they serve.

14 They include municipal gas distribution
15 systems, public utility districts, county districts,
16 and other public agencies that have natural gas
17 distribution facilities. APGA, whose members are
18 predominantly located in southern tier States, is
19 concerned that the NOPR, by eliminating non-condensing
20 furnaces from the marketplace, is, among other things,
21 taking away customer choice, discriminating against
22 low-income persons, and participating in fuel switching

1 to less efficient energy alternatives, all to the
2 detriment of the American public.

3 By proposing a nationwide 92% efficiency
4 standard for non-weatherized gas furnaces, our concern
5 is that DOE has made many of the same errors that
6 affected the 2011 direct final rule proceeding,
7 including as examples: a lack of transparency, failure
8 to recognize non-condensing furnaces as a separate
9 product class, failure to account properly for fuel
10 switching, reliance on proprietary data, data
11 averaging, et cetera.

12 Of course, until the transparency issue is
13 satisfactorily addressed, APGA and the other
14 interested parties that care about compliance with
15 the Energy Policy and Conservation Act are precluded
16 from meaningfully participating in this proceeding
17 and from informing the record of the seriousness of
18 the problems that may render the NOPR in
19 contravention of the EPCA.

20 While a prepared statement addresses each
21 of the various shortcomings just noted, albeit in
22 abbreviated fashion, since we currently do not have

1 sufficient information to do the necessary analysis
2 of the NOPR, I want to focus my remarks on the
3 transparency issue as that is really the key to
4 understanding the errors that may underline the NOPR.

5 I am accompanied by technical experts from
6 the Gas Technology Institute, an independent
7 non-profit technology organization engaged in
8 research and development addressing energy issues.
9 GTI has been engaged by APGA and the American Gas
10 Association to assist in analyzing the NOPR and its
11 technical underpinnings.

12 The DOE, in its analysis of life-cycle costs
13 and payback periods in the NOPR, relies on a
14 spreadsheet model combined with Crystal Ball software
15 to account for uncertainty and variability among the
16 input variables.

17 APGA's experience in the 2011 direct final
18 rule proceeding taught us just how complex and opaque
19 Crystal Ball software, as used by DOE and its
20 contractors, can be. In an effort to understand the
21 DOE's use of the Crystal Ball software and
22 simplifications, we have, with the assistance of GTI,

1 submitted questions to DOE.

2 Prior to the issuance of the NOPR, DOE
3 declined to answer the most important of those
4 questions on the ground that they were involved with the
5 deliberative process and hence could not be answered
6 until after the NOPR issued. The NOPR has issued, and
7 our questions remain unanswered. Our concern is time
8 to comment on the NOPR is quickly dissipating.

9 We need answers to our questions as soon
10 as possible; hopefully, those may be forthcoming today,
11 but in any event no later than April 3rd so that
12 meaningful analysis can proceed. Thank you for
13 permitting APGA to express its preliminary views on
14 the NOPR process. We are hopeful that a meaningful,
15 substantive exchange will occur today between the DOE
16 technical experts and the representatives from GTI,
17 thank you.

18 MR. BROOKMAN: Thank you. Other opening
19 statements, comments here at the outset? John?

20 MR. HODGES: Yes, John Hodges for the
21 National Propane Gas Association, NPGA. NPGA is the
22 national trade association representing the U.S.

1 propane industry. Its members include small businesses
2 and large corporations engaged in the retail
3 marketing of propane gas and appliances, producers
4 and wholesalers of propane equipment, manufacturers
5 and distributors of propane gas appliances and
6 equipment, fabricators of propane gas cylinders and
7 tanks, and propane transporters.

8 With membership of approximately 2,800
9 companies in all 50 States, 38 affiliated State or
10 regional associations, and members of 19 foreign
11 countries, NPGA represents every segment of the
12 propane industry. NPGA appreciates DOE's desire to
13 advance energy efficiency and conservation in
14 relation to residential furnaces, but is concerned
15 that the proposed rule may well have a negative
16 impact on the residential furnace market, both for
17 consumers and for fuel suppliers such as retail
18 propane marketers.

19 For example, furnaces with a required 92%
20 AFUE would result in positive pressure in the venting
21 systems, thus prohibiting direct replacement for an
22 existing natural draft furnace or entered an existing

1 application such as when a furnace and gas water
2 heater are commonly vented into a masonry chimney. A
3 92% AFUE furnace would also need a dedicated vent
4 discharged to an appropriate outside area that may
5 not be within close proximity to an existing furnace.

6 Any of these circumstances would add both
7 cost to reconfigure the venting system and potential
8 safety concerns if in the case of an orphaned water
9 heater, the water heater vent is not properly sized.
10 These could well be deemed unacceptable in the
11 marketplace, and we are concerned that the proposal, if
12 finalized, would result in a significant percentage of
13 fuel switching by furnace owners.

14 Suffice it to say, the propane industry
15 shares many of the same concerns as the natural gas
16 industry. NPGA continues to analyze the proposal and
17 will provide more detailed written comments by the
18 deadline. Thank you.

19 MR. BROOKMAN: Additional comments here?
20 Yes please, Kathryn?

21 MS. CLAY: Good morning, my name is Kathryn
22 Clay. I'm the Vice-President for Policy Strategy with

1 the American Gas Association, and we appreciate the
2 opportunity to be here today to present our views on
3 the Notice of Proposed Rulemaking on Energy
4 Conservation Standards for Residential Furnaces.

5 AGA and its member companies, as John noted,
6 are strong advocates for energy efficiency in all
7 direct use applications of natural gas. Nationally,
8 natural gas utility-supported energy efficiency
9 programs had investments exceeding 1.1 billion
10 dollars in both 2012 and 2013, and AGA member
11 companies reported budgets of 1.4 billion for energy
12 efficiency programs in 2014.

13 Through these energy efficiency
14 investments, AGA members have helped customers save
15 151 trillion BTU of energy, and offset 7.9 million
16 metric tons of carbon dioxide in 2013 alone. AGA is
17 concerned that the DOE proposal to adopt a national
18 92% AFUE standard for non-weatherized natural gas
19 furnaces will have serious negative unintended
20 consequences. Our preliminary analysis of the
21 information made available to date concerning the
22 rule indicates that it will impose significant

1 economic burdens to American consumers while
2 providing substantially lower actual energy savings than
3 indicated by the DOE technical support documents.

4 AGA is also deeply concerned by the
5 Department's consistent lack of transparency
6 throughout this rulemaking process. In a number of
7 critical areas, the Department has obscured the
8 assumptions, the data, and the methodologies contained
9 in the technical documents in support of this rule.
10 Despite written inquiries, questions submitted by AGA
11 to the DOE have gone almost completely unanswered.
12 This is particularly troubling given the immense
13 complexity of the proposed rule and the reliance on
14 highly sophisticated and opaque modeling
15 methodologies.

16 In particular, we are concerned that much
17 of the DOE analysis has relied on the methodologies
18 that are either proprietary or otherwise outside of
19 the public domain, and the Department has failed to
20 provide sufficient information needed by AGA due to
21 all of these factors for AGA or any member of the
22 public to develop a clear understanding of the technical

1 analysis behind this rulemaking, and, as a result, it is
2 impossible to ascertain whether or not this proposed
3 rule actually meets the criteria established by EPCA
4 for establishing new or amended standards.

5 AGA respectfully requests that the
6 Department provide all information requested to date,
7 especially that that had been previously withheld as
8 deliberative, and in light of the complexity and the
9 delay in access to the information, we also
10 respectfully request an extension in the comment
11 period to allow all parties to have suitable time to
12 analyze the newly provided information in the context
13 of this very complex and sophisticated rule.

14 AGA, though, has moved forward to review the
15 alluded information that has been made available in
16 the work referred to by APGA, and we have worked in
17 concert with APGA to hire GTI to help us make sense
18 of these very complex technical documents, and based
19 on our preliminary understanding from the work to
20 date, we believe that DOE's economic analysis
21 significantly underestimates the cost to consumers
22 and the other adverse impacts that the amended

1 standards would impose.

2 We are concerned that the 92% AFUE
3 proposed standards would impose burdensome costs and
4 potentially costs and in fact environmental negative
5 consequences due to fuel switching and other factors.
6 Even according to the Department's own analysis, the
7 majority of affected households would see no benefit,
8 some of them bearing higher net costs under the
9 proposed rule. It is especially objectionable that
10 this rule would place an undue burden on the low-
11 income consumers who will be unable to overcome the
12 initial barriers presented by the higher unit costs
13 of condensing furnaces or costs needed for renovations to
14 retrofit a condensing furnace if at all possible.

15 According to DOE's analysis, 20% of
16 households nationwide would see a net life-cycle cost
17 increase; 31% of consumers in the southern region
18 would experience net life-cycle cost increases, and, in
19 particular, again, low-income consumers would be
20 disproportionately affected. For example, 39% of low-
21 income consumers in the south, according to DOE, would
22 bear net life-cycle cost increases. EPCA is intended

1 to be a pro-consumer statute, and a proposed standard
2 such as this that makes many consumers worse off
3 should be reasonably reconsidered and should not be
4 reasonably considered to be economically justified.

5 I would like to note briefly some of the
6 major areas in the technical analysis that we believe,
7 with proper reconsideration, would actually make these
8 numbers and impacts on consumers even worse. Working
9 with GTI and our initial understanding to date of the
10 technical impacts, we note the following deficiencies
11 in the DOE analysis.

12 First, DOE underestimates the adverse
13 effects of fuel switching as consumers are forced
14 away from natural gas options to less-efficient
15 heating choices.

16 Secondly, we are concerned that DOE
17 overestimates product lifetime using significantly
18 higher estimates of 21.5 years, significantly higher
19 than industry-accepted estimates of 15 to 16 years.
20 Also, the Department over-estimates the size of the
21 affected market. The impact of this, of course, is
22 that by over-estimating the size of the market, it

1 also tends to inflate the projected benefits of the
2 rule.

3 And, finally, DOE uses unexplained and
4 inconsistent installation costs in its life-cycle cost
5 analysis. Particularly troubling, these are, on their
6 face, substantially different than some of the numbers
7 used in 2011; no citations or explanations for such
8 drastic changes in the numbers have been included --
9 why these numbers would change so dramatically over a
10 3-year period.

11 In closing, we hope that the Department
12 will act quickly to address these needs and the needs
13 of the public by supplying full access to its data
14 assumptions and methodologies. This is foundational
15 to our ability to assess the full implications of
16 this proposed rule in any meaningful way. Thank you
17 for the opportunity to comment, and I look forward to
18 the discussion.

19 MR. BROOKMAN: Thank you. Additional
20 comments here at the outset? Andrew, Andrew deLaski.

21 MR. DELASKI: Andrew deLaski, Appliance
22 Standards Awareness Project. Based on the coalition

1 project, I know many of you. We work with a coalition
2 of energy efficiency advocates, environmental groups,
3 consumer groups, also with representatives from State
4 government in the utility sector. We are active in
5 many of these proceedings for advancing energy
6 efficiency standards.

7 We have been active in each of the prior
8 steps of this rulemaking as well. I want to first in
9 this opening comment, I want to thank DOE for sticking
10 with the schedule outlined by the settlement in the
11 APGA litigation, so DOE has, as far as I can tell, done
12 a very nice job of proceeding with this process as
13 anticipated by the requirements of the settlement and
14 doing a working group last fall to give folks an early look
15 at the analysis, holding a public workshop that was a
16 very good and constructive step in publishing
17 multiple analyses in support of the NOPR.

18 I actually found it quite clear the
19 material that has been published, and I think DOE has
20 really gone beyond the usual steps to provide a level
21 of transparency for stakeholders to be able to
22 understand the analysis. Now, I understand people

1 have questions, and I hope the Department will answer
2 those questions to the full extent that you are able
3 to while complying with the law, and I expect that you
4 will.

5 I don't know if that was typically what
6 you do, but I don't see why it would be different in
7 this docket, and I hope that today we can continue the
8 kind of frank exchange that we have been having to
9 answer those questions, and I hope they can be
10 answered because I think that will help everybody to
11 understand what the analysis shows.

12 I also want to thank all the stakeholders
13 in the room. This has been a long process, and we have
14 had a lot of public meetings over the years. This is
15 the biggest one so far. I mean, it's not surprising to
16 me to see a lot of folks from the gas industry here.

17 This standard will save more natural gas
18 than any other standard ever issued by the Department,
19 so it is natural that the natural gas industry is
20 here in force to participate because it is going to
21 save a ton of gas. The closest rule is the water
22 heater rule from 2000.

1 So it saves a ton of gas, that's a good
2 thing for consumers; it's a good thing for the
3 environment, and that is something that we support. I
4 want to also say a couple of things about the process
5 up until now. There has been a lot of collaboration,
6 as everybody in this room knows. We, the advocates, and
7 AHRI came up with a proposal for a joint
8 recommendation for a standard that was adopted by the
9 Department, and that collaboration, that was very
10 constructive.

11 It ultimately was overturned by litigation,
12 but it was a good collaborative relationship, one that
13 has been continued since then in open and frank
14 discussions. So there also was good collaboration
15 with AGA in developing an approach to address what
16 was described to us as the small number of consumers
17 who faced very high costs and certain specific
18 circumstances, and we came up jointly with a proposal
19 for waivers that we will share with the Department,
20 but ultimately that process came up against the
21 shoals of the litigation.

22 So that collaboration, I thought, was quite

1 constructive and would have addressed some of the
2 narrow concerns raised by the gas industry. So I
3 hope that we can continue the kind of collaborative
4 discussions both today and after today that have
5 helped folks to wrap their minds creatively around
6 the opportunity to achieve large savings with new
7 natural gas furnace standards.

8 It's my hope and my expectation that
9 ultimately we will be able to arrive at a final
10 standard, which is due I think next year, the end of
11 next March, that will achieve at least the savings
12 that are expected by the proposed rule, and I expect
13 that by collaborating, working together, we can
14 increase those savings. We can arrive at a solution
15 that would be even more favorable, and precisely how
16 that is to be done I think depends on the creativity
17 and the goodwill and the ability of the folks in this
18 room to work together to address and identify the
19 narrow concerns and to address them.

20 With respect to the proposed rule, we
21 support it. We think it is a good solution. 92%
22 AFUE nationally, as I said, it saves more natural gas

1 than any standard in the DOE's history. The net
2 savings is 3.1 quads over a thirty-year analysis
3 period, most of that in natural gas, but that includes the

4
5 30

6
7 standby electricity consumption savings, with a net
8 present value that benefits consumers at 3.1 to 16.1
9 billion dollars depending on the discount rate that
10 you use.

11 We know that the higher level of 95% would
12 yield even more savings and also be more, more net
13 savings economically for consumers. The net energy
14 savings would rise to 4.4 quads, and the NPV would
15 rise by 5 billion to almost 25 billion dollars in net
16 present value savings to consumers over the analysis
17 period. These are enormous savings, energy savings
18 and economic savings.

19 We have only begun our review of DOE's
20 technical analysis. As I said earlier, we have found them
21 to be clear, but we have found several items that
22 concern us. It's our view that if these items are

1 corrected, we expect that DOE's analysis will show
2 that the proposed standards save even more energy and are
3 even more cost-effective than DOE has estimated in
4 the NOPR documents.

5 I'll outline briefly right now some items
6 that we think need correction as DOE moves forward to
7 a final rule.

8 First of all, manufacturer impacts -- DOE
9 justifies its decision to go with a 92% standard based
10 on the cumulative regulatory burden on manufacturers.
11 DOE essentially says in their walk down, if not for
12 the cumulative regulatory burden we would go to this;
13 95% looks pretty attractive. We think DOE
14 over-estimated manufacturing impacts really in two
15 ways.

16 First is that the impacts on manufacturers
17 are primarily driven by the decline in shipments, but
18 where are those shipments going? They are going to
19 heat pumps and to electric furnaces. The way DOE
20 does the manufacturer impact analysis is that it
21 looked at the furnace division of the manufacturers,
22 but the manufacturers who make furnaces are the same

1 exact manufacturers who make heat pumps and electric
2 furnaces.

3 As we understand it, the economic analysis
4 includes the impact on consumers who buy alternative
5 equipment. We think the manufacturer impact analysis
6 as well should look at the impact across the entire
7 spectrum of equipment that is affected.

8 The second point is fuel switching. We
9 applaud the Department for including fuel switching
10 in the analysis. It was something that AGA requested
11 that was a priority for AGA, and we appreciate the
12 Department has now included fuel switching in the
13 analysis.

14 We think that you have over-estimated the
15 fuel switching, the rate of fuel switching. You use
16 a model that depends on evaluating a payback. We
17 think that the model is a good approach in terms of
18 developing an economic basis for switching; however,
19 we think we haven't really accounted for the
20 stickiness, the inertia of consumer decision making.

21 So if the model was adjusted to account
22 for the consumer behavior that people tend to do what

1 they did before, inertia, we think that you will find
2 that the results will show less switching than what
3 you have estimated. We would note that the switching
4 that has been estimated is about the same as the
5 switching that GTI estimated in their materials
6 submitted to the Department last fall.

7 With that change in the analysis, you will
8 see increased savings and also reduced impacts on
9 manufacturers.

10 Third is learning rates -- we believe the
11 Department has understated some of the benefits of the
12 learning rates for equipment, really for two reasons.
13 First is that the learning rates are based on
14 furnaces as a whole as opposed to condensing
15 furnaces, and if you look at the learning rate for
16 condensing furnaces, you are going to see that you are
17 doubling the rate of condensing furnaces faster than
18 you are doubling the rate of conventional furnaces or
19 furnaces as a whole, so capturing the incremental
20 learning rate is the key issue the Department needs
21 to grab.

22 And the second thing on learning rates is

1 that we think the data is compromised in the years in
2 which there are Federal tax credits in effect. With
3 that correction, you will find that the learning rates
4 will actually increase.

5 Fourth, installation costs are
6 over-estimated. DOE does not account for new
7 technologies; these technologies are described in an
8 appendix to the TSD, polypropylene vents.
9 Manufacturers like DuraVent and Centrotherm are in
10 the market today providing products. These products
11 are designed to provide venting solutions for some of
12 the various hard-to-vent situations that the gas
13 industry has highlighted, and they will have helped to
14 reduce the costs for those consumers who face those
15 tough installations.

16 DOE also needs to apply learning to the
17 venting technology and to the practice of venting.

18 Fifth, this is a small point, but it
19 relates to the stand-by. We think DOE has
20 over-estimated the costs on standby. There is a
21 discrepancy between the cost of the TSD and NOPR
22 which needs to be resolved.

1 Sixth, we think DOE's baseline market
2 shares for condensing furnaces are too high. We have
3 data from a couple of States. We have compared those
4 to the data the Department has published, and those
5 costs -- the rate of condensing in existing States -- is
6 not as high as the Department has shown it to be in
7 the analysis. We have data from the northwest that
8 shows it to be different than what you have shown. I
9 am surprised to see West Virginia is projected at 95%
10 condensing; that doesn't strike me as correct,
11 particularly when bordering States are lower.

12 We think the market continues to be first-
13 cost-driven in many States and that that will lead to
14 a lower rate of condensing than what the Department has
15 projected.

16 And then, seventh and finally, we think the
17 Department has not accurately estimated the
18 distribution of efficiency post-standard. The
19 Department has done a very nice job of showing the
20 distribution of efficiency among condensing products
21 today, and I was pleasantly surprised to see that the
22 most common choice for a condensing furnace in

1 northern replacements is a 95% furnace; yet the
2 Department assumes that everybody who would have
3 bought something below the standard, buys precisely
4 the standard, a roll-up scenario, is a common problem
5 of these rulemakings.

6 We think a more realistic assumption is
7 that consumers will -- it will be a selection of
8 condensing values above the standard that is
9 ultimately selected and that results in a different
10 estimate than what the Department has shown. The
11 Department often does this type of scenario in its
12 analyses, and we think it should be used as the
13 default scenario in this project.

14 So thanks for the opportunity to
15 participate, I look forward to ongoing discussions,
16 and I will continue to participate in this important
17 rulemaking.

18 MR. BROOKMAN: Thank you. Yes, Robin
19 please.

20 MR. ROY: Robin Roy, Natural Resource
21 Defense Council. We have been long supporters from
22 the very beginning of the Federal Energy Efficiency

1 Standards/Appliance Energy Standards. We have worked
2 on a lot of them, and we continue to work on them, and
3 we are really thankful for the program, and it's
4 delivered for environmental and consumer outcomes.

5 Great energy savings and great results
6 generally -- this particular standard has been a long
7 time coming. It's been almost a tortured path, and we
8 are looking forward to an effective and as timely as
9 possible resolution. I also say we work a lot on the
10 other approaches, other tools in the portfolio for
11 energy efficiency for consumer and environmental
12 benefits, supporting State and utility programs for
13 energy efficiency.

14 We are very thankful of AGA and its
15 members energy efficiency programs, the 1.4 billion
16 dollars I think is very effective, and I would love to
17 see it. It's a fantastic set of tools. Interesting
18 in this case, there continues to be even with those
19 programs, there continues to be an opportunity, actually
20 a need for efficiency standards for furnaces. Only if
21 we had had a few more of those utility programs, a
22 bit more intensely funded, then maybe we wouldn't be

1 sitting here, but such is the case.

2 There is a large amount of efficiency
3 opportunity that is economic. We haven't heard
4 anybody suggest otherwise. NRDC has been working
5 very intensely on this particular rulemaking over
6 these last few years. We had been talking to many
7 stakeholders. We were very keen to work in that group
8 that Andrew mentioned a moment ago to develop a
9 waiver process that was really targeted to address
10 this issue, which had been raised so many times in our
11 discussions, of the most hardest effected small
12 subset typically associated with difficult
13 installation costs, and I am delighted to see some
14 work and an opportunity to drive down some of those
15 tough installation challenges, and that's very
16 encouraging, and we continue to be really interested
17 in that part of it.

18 We recognize that there is a continued
19 deep concern about households that may be worse off
20 by several hundred dollars, and that's what it looks
21 like from the analysis -- it's not in this package
22 here today, but you would see it in the technical

1 support document in figure 8.5.1, for example, that
2 shows 5% of households being worse off by several
3 hundred dollars.

4 We are very interested in what might be
5 done to mitigate that and achieve even greater cost-
6 effectiveness from this rule. We are also interested
7 in looking at tighter standards, for example a 95%
8 might that be brought into effect for appropriate
9 households. To those ends, we have been having lots
10 of discussions with manufacturers, with utilities,
11 with associations, with installers, with other
12 efficiency and environment groups. The kinds of
13 discussions, I think, that are probably hard for DOE to
14 have by the nature of the rulemaking process.

15 And those have been really quite
16 productive. We have had one-on-one discussions. We
17 have had small group discussions, and just a couple of
18 weeks ago, we had a terrific meeting with, I don't know,
19 about 35 parties from all over the place, and, for
20 those in this room who didn't participate, please see
21 us because we will continue to have these discussions.
22 Let me know if you are interested to see what might

1 be done, particularly for the issues which have been
2 raised before that continue to be raised and are a little
3 challenging for this one.

4 The 5% tail, I will just use as a shorthand for
5 this hard-off -- these worse-off households. We also
6 are recognizing, as Katheryn mentioned, that there is a
7 moderately or a fairly large subset of households in
8 the south for example, 40% or so, that will be worse
9 off, maybe not by very much, but something. We are
10 interested in seeing if something can be done there
11 too, if it's small amounts of money that's
12 unfortunate, and we would like to address it as soon
13 as possible.

14 So we are looking to see what might be
15 done with, for lack of a better term, flexibility
16 mechanisms. An example, the after-the-fact waiver and
17 the enforcement rulemaking from a few years ago that
18 several parties in this room proposed and even more
19 of the parties in this room discussed and negotiated,
20 not all coming to an agreement on it.

21 We think it's interesting. We also see
22 a regional standard as having some merit. It's a type

1 of flexibility which DOE has an opportunity to draw on.
2 We are very keen on the full array of what might be
3 done to make a more cost-effective standard that
4 addresses the particular challenges for the worst-
5 affected households. We think there are some paths
6 to that end, and we would love to get more discussion
7 from DOE on what you might see as the legal or
8 practical challenges to them.

9 It would be, for example, great to see what
10 your view was on the analog, the in-standards as
11 opposed to post-standard waiver process. You could
12 call it an exemption or something. I am sure there
13 has been a fair amount of legal thinking at GC on
14 those issues, but we can't glean that from anything in the
15 NOPR or the TSD.

16 But given the history, I am very
17 concerned with those issues. I hope we will see more
18 and be able to glean more of what you are thinking
19 and see if we can work towards solutions that would
20 fit within your view as being legal and enforceable
21 and effective.

22 Great work, we need to see this done.

1 There is too much energy opportunity, too much
2 consumer savings, and too much environmental benefit to
3 just let this go, so go as quickly as you can to get
4 this thing done.

5 MR. BROOKMAN: Steve Rosenstock?

6 MR. ROSENSTOCK: Steve Rosenstock, Edison
7 Electric Institute. Again I want to thank the
8 Department for having this hearing today. I am going
9 to really withhold most of my comments until we get
10 to some of the issues that affect the electric
11 industry, such as the issue of fuel switching and the
12 emissions analysis and national impact analysis.

13 But in opening, I just wanted to really say
14 I think we are going to have to remember some of the
15 context here in terms of competitive markets. Right
16 now the standards for heat pumps have gone up twice
17 in the last 9 years, the first time from 10 to 13 [SEER] in
18 January of 2006, the second time as part of the court
19 settlement from 13 to 14 [SEER] and then with corresponding
20 level and the HSPF 6.8 to 7.7 in 2006 and now 7.7 to
21 8.2 now.

22 Any analysis that is done in terms of fuel

1 switching really needs to take that in account as
2 well. The market has shifted, the costs have
3 increased on the heat pump side, and by not even
4 talking about that, the current analysis is incomplete,
5 and I will provide more details later. I look
6 forward to the discussion and thank you very much.

7 MR. BROOKMAN: Thank you, additional
8 comments before we launch into this detailed review.
9 Frank Stanonik.

10 MR. STANONIK: Frank Stanonik, AHRI. I
11 haven't prepared comments but just a couple of things
12 I do want to bring. First of all, yes, we have been
13 involved with a lot of other people trying to find
14 the, let's say, the appropriate solution that would be
15 acceptable to all parties. I will tell you that the
16 proposed level by DOE is not acceptable to AHRI's
17 members, and I would also just remind everyone that we
18 are looking at the solution that is both saving
19 energy and economically justified, and we should not
20 forget that second part.

21 And the last point I want to raise is that
22 we are also looking at the energy that might be saved

1 by a rule in comparison to what energy savings occurs
2 in the absence of the rule, and you will see in slides
3 and other places, it is, in this case, for a case of
4 residential furnaces, unavoidable to notice that, first
5 of all, as Steve might mention, there really hasn't
6 been a change in the first rule, depending what you
7 consider the 80% that comes in November -- if you
8 consider that a change okay there's been a change
9 coming in, but I would say there really hasn't been a
10 change since NAECA, and yet without question, whatever
11 the right number is today, certainly the current
12 market is about one out of every two furnaces shipped
13 to the United States and going into somebody's house
14 is a condensing furnace.

15 So there is a huge amount of savings that
16 the industry has achieved without standards, or
17 without changes in the standards, and so as we talk
18 about this rule, we need to keep in mind we are
19 looking at the savings the rule achieves as opposed
20 to what will happen if the industry just goes along
21 and deals with incentive programs, deals with getting
22 the products where they need to be, where they make

1 the most economic sense.

2 MR. BROOKMAN: Okay thank you, Susan
3 Stantley joining us on online, Susan we are going to
4 unmute your phone. Please speak. We haven't heard you
5 yet okay. So then maybe she will join us in a
6 moment. Additional opening remarks here before we
7 get into the details? Okay let's then proceed with
8 the slides and back to John Cymbalsky.

9 MR. CYMBALSKY: Okay thanks Doug. John
10 Cymbalsky, DOE. I am just throwing this up here, this
11 is our usual slide that highlights the issues that we
12 will be expressly asking for comment on. As we go
13 through, you will see these issue boxes, and then we
14 will pause at that point for comments from the
15 stakeholders.

16 Okay so let's get right into the content
17 here starting with the regulatory authority. So EPCA of
18 1975 established the Energy Conservation Program for
19 Consumer Products Other Than Automobiles, which covers
20 the furnaces that we will be discussing here today.
21 NAECA 1987, as Frank just mentioned, amended EPCA to
22 prescribe the first standards for furnaces, and it

1 directed DOE to conduct two further rulemakings to
2 determine whether or not amended standards were
3 warranted, and so here we are today.

4 EISA 2007 amended EPCA to [require DOE to] review
5 standards every six years and also required that standards
6 after July 1, 2010 look at standby and off mode.

7 Okay, so per the history as I just mentioned, the initial
8 standards were established by NAECA in 1987 except
9 for small furnaces, and DOE published a final rule on
10 November 17, 1989 to set initial standards for small
11 furnaces, and you can see the Federal Register cite.

12 DOE also published a final rule on
13 November 19, 2007 that amended standards for most
14 classes of furnaces manufactured on or after November
15 19, 2015, and it did not update standards for mobile
16 home oil-fired furnaces and weatherized oil-fired
17 furnaces.

18 DOE also published the direct final rule
19 on June 27, 2011, and it amended the AFUE standards
20 for non-weatherized gas furnaces, mobile home gas
21 furnaces, and non-weatherized oil furnaces. It
22 amended the compliance date but left the existing

1 standards in place for weatherized gas furnaces, and
2 it established electrical standby and off mode
3 standards for non-weatherized gas furnaces,
4 non-weatherized oil furnaces, and electric furnaces.

5 So following the 2011 DFR, we have already
6 heard a little bit about this in Andrew's opening
7 remarks. We went through, and DOE was remanded the rule.
8 The court approved a DOE and APGA settlement on April
9 24, 2014. Again, DOE was remanded the rule, and here we are
10 in today's proceeding, and, as Andrew mentioned, we are
11 proceeding on schedule with the Court's ruling.

12 So the current standards for
13 non-weatherized gas furnaces and mobile home gas
14 furnaces were established by NAECA and were effective
15 in 1992 and 1990 respectively. The November 2007
16 final rule revised the final AFUE standards, and
17 compliance is in November of 2015, and you could see
18 those numbers below.

19 We had a question from Mark Naves from
20 Southside Heating and Air Conditioning asking about
21 what this standard we are talking about would do. So
22 it's a manufacturing standard, and his question

1 related to how would people install 80 AFUE furnaces.
2 The standard is on manufacturing, so they would -- the
3 manufacturers would not be able to actually make
4 those furnaces, so I hope that answers your question.

5 The next slide talks about the criteria
6 for setting standards, and a lot of people have
7 already referred to a few of these in their opening
8 remarks using words like technically feasible and
9 economically justified, so you could see the
10 difference factors in EPCA and how the different DOE
11 analyses address each one of these, but just to hit on
12 a few you know, there are issues of competition,
13 utility, energy savings, operating costs, et cetera.

14 So I think the slide deck does a good job
15 of going through these today. There is a lot of
16 content, a lot of pretty heavy-duty content, but
17 hopefully, we will get through all of it. We are going to
18 do our best to answer everybody's questions, and as I
19 said in the opening, we are going to flag certain
20 areas of concern as we go through.

21 MR. BROOKMAN: Okay, thank you John.

22 Suzanne Stantley I think has joined us again, and

1 Suzanne, we will now unmute your phone. Please say
2 your organizational affiliation as well.

3 MS. STANTLEY: Good morning, and I will.
4 Thank you for the opportunity to speak today on the
5 Department of Energy's proposed standard for minimum
6 efficiency standards for natural gas furnaces.
7 Again my name is Suzanne Stantley, I am the CEO of
8 Contractor Advisors Business Development out of
9 Chicago, Illinois. I am active in my community,
10 working on a daily basis to find ways to increase
11 economic viability for minority-owned businesses and
12 consistently seeking solutions to create economic
13 opportunity.

14 I am speaking today on behalf of low-
15 income residents in my community that I believe would
16 be hurt by the rule if it is allowed to go into
17 effect. As I understand it, energy efficiency
18 programs are supposed to help consumers save money on
19 energy costs, but this rule will do the opposite, and
20 it will impact low-income families hardest.

21 The proposed furnace rule would force many
22 low-income residents to either pay large amounts for

1 condensing furnaces or switch to more expensive
2 electric heating when their existing non-condensing
3 furnaces need to be replaced. Non-condensing
4 furnaces are in most homes today.

5 The Chicago area already suffers from
6 higher than national average electricity costs,
7 while the city has lower than average natural gas
8 costs. Condensing furnaces cost about \$350.00 more
9 than non-condensing furnaces and can cost an
10 additional \$1,500 to \$2,200 to be installed. Low- and
11 moderate-income families throughout Chicago would be
12 severely hurt by this rule if more of their household
13 income would have to go to pay for basic heating.

14 Many of these families will have to make
15 hard choices. In addition, the cost increases would
16 further deplete an already strained low-income home
17 energy assistance program, LAHI funding. Nationally,
18 LAHI funding has been reduced 34% from \$5.1 billion in
19 2010 to only \$3.4 billion in 2015.

20 The resulting allotment for Illinois has
21 decreased 31% from \$232.09 million in 2010 to only
22 \$165.5 million in 2015. This reduction in LAHI

1 funding has already denied over 89,000 former
2 recipients of this desperately needed assistance.
3 The new furnace standard proposed by DOE would push
4 low-income families toward more costly and less-
5 energy-efficient options like electric resistance
6 heating.

7 That means heating costs will go up and
8 LAHI assistance will be available to even fewer
9 families than it is today, and so I am here to ask the
10 Department of Energy not to move forward with this
11 proposal, as I know the impact it will have on my
12 community and those with whom I work on a daily
13 basis.

14 As an advocate for energy efficiency and
15 an advocate for economic opportunity, I urge you to
16 find the necessary solutions to achieve energy
17 efficiency without causing residents in the
18 communities I serve to pay more in monthly heating
19 costs and, in the end, operate less-energy-efficient
20 furnaces.

21 Thank you again for this opportunity to
22 speak today.

1 MR. BROOKMAN: Okay, thank you. Now let's
2 proceed with the slides and go to the engineering
3 analysis.

4 MR. DARLINGTON: Good morning, everyone.
5 I'm Adam Darlington with Navigant Consulting. I am
6 going to go over the rulemaking scope and the
7 engineering analysis.

8 MR. BROOKMAN: Let me make a comment here.
9 There's a lot of content in this package here today.
10 We need to be, I think, disciplined in the discussion
11 segment. We want to hear everything you have to say
12 but let's keep a focus here. Okay, let's try and be
13 concise with our comments as we go along. Do you
14 wish to say something at the outset?

15 UNIDENTIFIED SPEAKER: Is this available
16 electronically with the DOE webinar?

17 MR. CYMBALSKY: So we had that question,
18 and I think Alex has emailed a few of them that asked
19 for it, but it generally goes into the docket after
20 the meeting, yeah.

21 MR. BROOKMAN: Thank you, now we are going
22 to proceed.

1 MR. DARLINGTON: All right, with that said,
2 we have a lot of ground to cover, so I will go through
3 this as quickly as I can, but do feel free to stop me
4 if you need to ask any questions.

5 So just briefly, the scope -- basically the
6 scope of this rulemaking exercise is outlined by
7 the definition in EPCA for residential furnace. The key
8 points here we are looking at are single-phase electric
9 units; I'm sorry -- for units that use electricity, we
10 are looking at single-phase units, natural gas
11 furnaces, and that have an input rate of 225,000 BTU
12 per hour or less, and, I think as was alluded to
13 earlier, as a result of the remand agreement, this
14 analysis is covering two classes of furnaces and those
15 are the non-weatherized gas furnaces and mobile home
16 gas furnaces.

17 So now I am moving to the engineering
18 analysis. The purpose of the engineering analysis is
19 to determine how manufacturer costs and selling price
20 changes with increasing efficiency. For the analysis
21 of AFUE standards, DOE has relied on an efficiency
22 level approach, which means that the analysis was

1 focused on analyzing selected efficiency levels at
2 which DOE estimated the manufacturer production costs
3 and selling prices.

4 DOE used a reverse engineering analysis
5 which we will talk through in the coming slides and
6 also relied on a variety of information as listed
7 here on the slides. So this slide just shows an
8 overview of the steps in the engineering analysis,
9 starting with inputs from the market and technology
10 assessment going from the selection of the efficiency
11 levels that DOE is going to analyze all the way
12 through to developing industry average, manufacturer
13 selling prices, and so we will sort of talk through
14 each of these steps in the coming slides, so I won't
15 spend too much time here.

16 So as mentioned, the first step is
17 selecting the efficiency levels for analysis. And so
18 this was informed by product efficiency data
19 collected during the market assessment. DOE analyzed
20 the baseline level, which is 80% for both the
21 non-weatherized gas furnace and mobile home gas
22 furnace equipment classes.

1 There is correspondence on the minimum
2 standard that was adopted previously in the 2007
3 final rule. DOE also analyzed the max-tech levels,
4 which are the most efficient products available, and
5 in between these levels, DOE looked at several
6 intermediate levels, mainly at the most common
7 efficiency levels available on the market, also at
8 levels that represent a major change in technology,
9 for example the 90% example for non-weatherized gas,
10 a big jump from non-condensing to condensing.

11 And so the table on this side shows all of
12 the efficiency levels that were analyzed as part of
13 this analysis.

14 So this slide talks about the selection of
15 units for the teardown analysis, which is the reverse
16 engineering analysis. DOE selected quite a few units,
17 as shown in this table at the bottom of the slide.
18 The selections span the range of efficiency levels
19 analyzed and were focused on the representative input
20 capacity of 80,000 BTU per hour; so the models that
21 were primarily selected at that input were
22 as close as possible, but we did also look at

1 some units above and below that in order to get an
2 idea of how the analysis would scale to large and
3 smaller units.

4 And so at each efficiency level, products
5 from multiple manufacturers were chosen for tear down,
6 and this allowed for the direct comparison of
7 efficiency levels for a given manufacturer, and it
8 sort of allowed DOE to key in on the differences in
9 designs and the costs which will achieve the
10 different efficiency levels.

11 So we were able to look at the
12 manufacturers specific matched pairs of products
13 which represented the cost to increase fuel efficiency. And
14 so
15 as this slide shows, you know, as I mentioned, quite a
16 few units were selected. They were focused around the
17 levels that DOE analyzed, so quite a few teardowns at
18 80% which is the baseline, quite a few at 90%, quite
19 a few at 92% and 95%, and then at 98% (max-tech) we had two
20 teardowns there, and basically, there were two
21 manufacturers producing products there, so we looked
22 at both of them at the representative capacity.

1 So then, for each teardown, basically what
2 DOE does is they physically disassemble the unit
3 into its components, log the parts along with the
4 materials, dimensions, weights, and manufacturing
5 processes to create a spreadsheet of building
6 materials. DOE uses the building materials developed
7 from the teardown to develop the cost estimate for
8 each unit torn down.

9 DOE also does manufacturer interviews and
10 talks to the manufacturers about its cost estimates
11 to get some feedback and get some help with
12 calibrating some of these estimates. Yes?

13 MR. BROOKMAN: Frank Stanonik?

14 MR. STANONIK: Frank Stanonik, AHRI. Adam
15 just a quick question.

16 MR. DARLINGTON: Sure.

17 MR. STANONIK: You said something about
18 looking at pairs of something, so I just want to
19 confirm that in all of these teardowns, let's say for
20 every one of the -- obviously you looked at 8 models of
21 rated units at 80%, and I'll just assume there was at
22 least one from each major manufacturer.

1 Does that mean that you also looked at a
2 higher condensing model from the same manufacturer as
3 compared to the 80% to look at this pair situation?

4 MR. DARLINGTON: Yeah, that's right, and
5 that's what we set out to do in order to tell what
6 the incremental difference is, so, and then you see a
7 little bit of spread here, you know. Obviously, not
8 all manufacturers are making the 92%, so for somebody
9 with the 93% and compare that to their 80% instead of a
10 92%, so yes, but yes to your question.

11 MR. BROOKMAN: Mark?

12 MR. KREBS: Mark Krebs with Laclede Group.

13 MR. BROOKMAN: Is your mic on?

14 MR. KREBS: Yeah, it is. Since I got here,
15 I have always wondered a lot about this teardown
16 stuff, you know, all of those units you bought and
17 tore down. , I assume you purchased those, correct?

18 MR. DARLINGTON: Yes.

19 MR. KREBS: Okay, any idea what that cost
20 and total amount of man-hours necessary for the tear
21 down task?

22 MR. DARLINGTON: No, I have never run the

1 numbers on that, so I couldn't give you an estimate.

2 MR. BROOKMAN: Jim?

3 MR. VERSHAW: Jim VerShaw, Ingersoll Rand.

4 So you have purchased the furnaces. Did you take the
5 purchase price that you paid for those furnaces and
6 compare that with what you came up with as an
7 estimate for the cost? Did you ever show that?

8 MR. DARLINGTON: We don't show that, but it
9 is done to sort of calibrate.

10 MR. BROOKMAN: Mike Rivest?

11 MR. RIVEST: This is Mike Rivest from
12 Navigant. I'm the one who has to sign the purchase
13 orders. You know, we are not an authorized
14 distributor or reseller or Trane carrier, so we end up
15 paying very different prices than I did when I was a
16 contractor, for example.

17 So the prices that we pay are not
18 representative of what the distribution chain would
19 pay, for example. There's a wide variation of what we
20 pay, so we couldn't reasonably compare that to our
21 manufacturing costs and make conclusions unless you
22 guys would be willing to provide that.

1 MR. BROOKMAN: Back to Adam.

2 MR. DARLINGTON: All right, so moving on.

3 I just want to note here a very important part of
4 this. An important issue to note is interplay with the
5 furnace fans final rule, which I think John alluded to
6 earlier. So as most of you I am sure are aware, DOE
7 published the furnace fans final rule in 2014, and the
8 compliance date for that is 2019.

9 The expected compliance date from this
10 rulemaking would be 2021, and so that furnace fan rule
11 will already require compliance by the time this one
12 would. So on the furnace fan final rule, DOE had
13 assumed certain technologies would be needed to be
14 implemented to meet those standards, and those are
15 listed here on the slide for both product classes.

16 And consistent with those assumptions, DOE
17 assumed that those technologies were going to be
18 implemented at the time this rule takes effect, and, as
19 a result, DOE accounted for those costs in the
20 baseline efficiency level and higher efficiency
21 levels as needed.

22 And so just going back to what John said

1 earlier about the questions APGA had submitted, I
2 believe this one is a primary driver and the answer
3 to priority question E which was related to the
4 difference in total installed cost between the 2011
5 analysis and this analysis, and a large factor in that
6 was accounting for these technologies used.

7 MR. CYMBALSKY: We think this also answers
8 question 2, in the section "Questions asked previously and
9 not answered by DOE.

10 MR. BROOKMAN: And that document John --

11 MR. CYMBALSKY: Is in the docket.

12 MR. BROOKMAN: Okay. It just seems like
13 the key point here, so additional questions, comments
14 related to this slide? Yes sir, please say your
15 name.

16 MR. SCHRODER: This is Dave Schroder. So
17 you are saying that the larger difference between
18 2011 and now is furnace fans?

19 MR. DARLINGTON: Yes, that's right as far
20 as the total installed costs for the consumer
21 changing. I think there are smaller changes, but this
22 is the primary driving factor.

1 MR. SCHRODER: And why is that change
2 larger in the 80% case than in the higher condensing
3 cases?

4 MR. DARLINGTON: Well, so at the max-tech --
5 this applies equally to 80% to 90% and the 92% and
6 the 95%, so as we talk through what we observed design
7 changes were at each level, when we talk about that,
8 the max-tech is a little bit different, so some of
9 these didn't need to be applied there.

10 As far as comparing the 80% to the 90% --

11 MR. RIVEST: Mike Rivest, Navigant. Adam,
12 you can only speak to the manufacturer sales price,
13 not installation costs.

14 MR. DARLINGTON: I was going to say as to
15 the specific differences for that, you know, if there
16 are other differences, we will get to those in the
17 installed costs later.

18 MR. BROOKMAN: If you wish to comment, come
19 to the microphone. Make sure it is turned on. Please
20 say your name.

21 MR. MURPHY: Rich Murphy, American Gas
22 Association. Just a follow-up question to the tear

1 16 down and buildup of the equipment costs and
2 ultimately the markups that are applied -- so Mike
3 from Navigant had explained that they build-up with
4 the manufacturer's cost and really don't have a
5 comparison to see how that resonates with what the
6 manufacturer's costs are, but that is what is used
7 to build up the actual retail price of the
8 equipment that having compared how that works against
9 what you actually pay for the equipment.

10 MR. BROOKMAN: Mike please speak up.

11 MR. RIVEST: We will get to that. I mean,
12 so we are building it up from the manufacturing cost.

13 MR. BROOKMAN: That's a dead spot for that
14 mic.

15 MR. RIVEST: So we will be building this
16 up from the manufacturing costs, literally the
17 production costs to the manufacturing sales price, and
18 then we will be taking it down the distribution chain
19 all the way to retailer cost, installed cost, and that
20 is -- that will take a few hours as we go through the
21 presentation.

22 And you know, this is not like a clothes

1 washer, for example where there is readily available
2 retail pricing. Even online, a lot of these products
3 are sold through dealer networks, and you can't just
4 buy a gas furnace necessarily for a lot of these
5 brands of things, and I see Karen Meyers has
6 something to say about that.

7 MS. MEYERS: So a lot of gas furnaces are
8 sold through contractors at Home Depot. It is
9 available to get pricing that is usually charged
10 based upon the installed cost, so that is not an entirely
11 accurate statement.

12 MR. RIVEST: It's not, well, I don't think
13 you can get all brands at Home Depot for example, so
14 that would become useful perhaps.

15 MS. MEYERS: You can get at least three or four
16 brands.

17 MR. BROOKMAN: Okay, thanks for the comment,
18 Karen, okay. Frank Stanonik?

19 MR. STANONIK: Frank Stanonik, AHRI. Adam,
20 you indicate here that you are assuming it is going
21 to be a two-stage product in the baseline, and for
22 some of us who were here yesterday afternoon talking

1 about revised test procedure, there is certainly some --
2 I will say at this point, some uncertainty as to what
3 kind of AFUE number you are going to get out of the
4 revised test procedure for two-stage products. Is
5 that factored into the analysis -- I mean let me
6 rephrase that.

7 How can you factor into the analysis what
8 the AFUE of this two-stage product will be as the
9 baseline when we have a test procedure that is right
10 now a little bit fluid and certainly might have some
11 effect on what value you get for that particular
12 design?

13 MR. DARLINGTON: In the test procedure, the
14 conclusion was that the impact would be de minimis, so
15 we went with that here. As far as the two-stage, I
16 think yesterday we heard that sometimes it improves
17 efficiency, but sometimes it would actually decrease
18 efficiency. It just depends on how the manufacturers
19 design it, so yeah, we really assumed that it would be
20 the same efficiency.

21 MS. ARMSTRONG: This is Ashley from DOE.
22 I think this gets to our discussion largely yesterday

1 about that we believe ratings won't change and,
2 generally speaking, I think we looked at the you know,
3 left that at DOE did some testing. We are going to
4 put additional details of that testing that
5 underlines that conclusion in the docket as
6 requested yesterday, but obviously, we welcome data if
7 someone has it that shows that we need to relook at
8 that conclusion, but generally speaking, we believe
9 that the test procedure proposals that we have made
10 will not change the rated values as you see them on
11 the market today.

12 MR. BROOKMAN: Keep going Adam.

13 MR. DARLINGTON: So after developing the
14 MPC estimates for the individual units that were torn
15 down, the next step was to aggregate the individual
16 teardown results into an industry cost-efficiency
17 relationship, and at the baseline, DOE used the market-
18 share-weighted average for each manufacturer to come
19 up with an industry average baseline cost.

20 So based on publicly-available information
21 and based on feedback during manufacturer interviews,
22 DOE estimated the market shares, and you know, as Frank

1 mentioned earlier in his assumption, we tore down
2 quite a few at the baseline and hit pretty much every
3 major manufacturer, so we market-share-weighted them
4 into an industry average baseline MPC.

5 So then at the intermediate levels above
6 the baseline, they start at 95% and go up to -- I'm
7 sorry, they start at 90% and go to the 95%, and so to
8 get to 95, DOE observed that manufacturers pretty much
9 universally utilized the secondary condensing heat
10 exchanger, and then within that range, typically the
11 changes were the size increases to the heat exchanger
12 as the driver of the increased efficiency and also
13 the increased product costs.

14 So within this range, DOE compared the teardown
15 results between the intermediate level and the
16 baseline for each manufacturer individually, to develop
17 manufacturer-specific incremental costs of achieving
18 each intermediate efficiency level, so it was almost
19 like an individual cost-efficiency relationship for
20 each manufacturer, which we then aggregated together to
21 get the industry cost, and then at the max-tech, since
22 we only had two and because the technology there was

1 a little bit different, so to get to the max-tech, we
2 were looking at the products available on the market.

3 It looked like they increased their size,
4 and then they also switched to modulating, and so,
5 looking at that, we compared the 98% teardowns for the
6 two max-tech units to the 95% to see exactly what
7 changed in that range as well.

8 And we used an average of those two -- a
9 weighted average, a market-share-weighted average of
10 those two numbers, to come up with the MPC
11 estimate at 98%.

12 So then for the mobile home gas furnaces,
13 DOE also did teardowns of several models to look at
14 the differences. Mainly, we were looking for
15 differences between the mobile home gas furnaces
16 and the non-weatherized gas furnaces. So when we did the
17 teardowns of mobile home gas furnaces, we had
18 teardowns from manufacturers that made both mobile
19 home gas furnaces and non-weatherized gas furnaces, so
20 we were looking at comparing the same manufacturer
21 with the same efficiency level to see the differences
22 between the models and come up with cost estimates.

1 So generally, the incremental cost-
2 differences between efficiency levels and the cost
3 efficiency trend and the design changes were fairly
4 similar, so the differential costs at each level for a
5 mobile home furnace as compared to a non-weatherized
6 gas furnace were used along with the industry
7 cost-efficiency estimates for the non-weatherized gas
8 furnaces to come up with estimates for the mobile home
9 gas furnaces.

10 And the next step was to develop the
11 estimate of the manufacturer selling price. So the
12 manufacturer selling price is calculated as the
13 manufacturer markup times the production cost plus
14 the shipping cost. Shipping costs were calculated
15 based on assumptions about typical trailer sizes and
16 the furnace size at each efficiency level, and those
17 are included in the TSD markups.

18 Markups are calculated initially based on
19 information from SEC 10-Ks for public companies, and
20 then they are calibrated based on information provided
21 in the manufacturer interviews. And so pretty much,
22 the conclusion of this is that DOE estimated the

1 manufacturing markup to be 1.34 for non-weatherized
2 gas [furnaces] and 1.27 for mobile home gas furnaces.

3 And so from there, this is what results
4 generally. So as I mentioned earlier, at 80% we have the
5 baseline. From 80% to 90%, you are basically
6 adding the condensing secondary heat exchanger, and
7 then within the range from 90% to 95%, increasing heat
8 exchanger
9 size, and above that increasing the heat exchanger size
10 even further and then adding modulation.

11 And so that brings us to the request for
12 comment about the analysis.

13 MR. BROOKMAN: Ashley Armstrong?

14 MS. ARMSTRONG: So this leaves -- and I'm
15 going to turn it right over to you but you had asked
16 a couple of questions, Mark from Laclede, regarding the
17 engineering analysis that you submitted beforehand,
18 and so we believe the slides that Adam just presented
19 more or less answer those questions directly in terms
20 of how we did our approach for the teardown
21 analysis.

22 We had a question as to what pricing

1 technology did DOE use for fan motors in the
2 baselines, which was specifically on slide 19, so I
3 just wanted to let you know that we answered your
4 questions on the previous slide, but should you have
5 more, please feel free to note that.

6 MR. KREBS: Well thanks for that
7 explanation. It really doesn't address my question,
8 but I'll deal with that. I have a couple of other
9 questions in regard to you, sir. You seem to be the
10 guy I should ask about BOM spreadsheets and cost
11 models that were referred to in the TSD, but we can't
12 seem to locate them, can you help us out?

13 MR. DARLINGTON: We don't make those
14 publicly available. So when we do our BOM
15 spreadsheets, which are the main input to our cost
16 estimates, they contain a lot of sensitive
17 manufacturing information, so we generally haven't
18 made those public. In the TSD, what we try to do, and
19 what I have tried to do here, is to sort of describe
20 what the changes are and what is driving the cost.

21 So if you need something more to feel
22 comfortable with, you know, I guess the ability to

1 review this, we can talk about it or just -- we don't
2 generally reveal that information.

3 MR. KREBS: Would a FOIA request get it?

4 MR. BROOKMAN: Mike Rivest?

5 MR. RIVEST: I'm trying to be helpful.

6 What is it you need it for?

7 MR. KREBS: We need it to verify your
8 costs to see how reasonable they are in our opinion
9 and --

10 MR. RIVEST: Do you need to know like the
11 cost of every component, because when we tear down
12 these products, we literally have the cost of every
13 single component, screw, nut, and these are real
14 products from real manufacturers, and there is a lot
15 of intellectual property and --

16 MR. KREBS: Let's cut to the chase here.
17 You know my analyst who requested these, Jim Moore
18 from the Laclede Group, is listening in on the webinar.
19 Let's let him call in the question so I'm the
20 interpreter of it, okay.

21 MR. BROOKMAN: Are there any other
22 questions while he is cuing up here? Any other

1 questions? We have a comment from Tom Archer from
2 Carrier, and his comment is -- is the baseline cost
3 utilized in the analysis a two-stage constant
4 torque BPM non-condensing versus a two-stage
5 constant torque BPM condensing?

6 MR. DARLINGTON: Could you read that one
7 more time Doug?

8 MR. BROOKMAN: Yes, is the baseline cost
9 utilized in the analysis a two-stage constant torque
10 BPM non-condensing verses a two-stage constant torque
11 BPM condensing?

12 MR. DARLINGTON: Yes.

13 MR. BROOKMAN: Okay, yes. Is your guy
14 going to call in his questions?

15 MR. KREBS: Yes.

16 MR. BROOKMAN: Okay. Mark Naves, yes you are
17 now unmuted. Please speak. I haven't heard you yet.
18 Okay, we are going to keep going, Adam, and maybe he can
19 join us in a little bit. Kathryn, please?

20 MS. CLAY: Maybe while we are waiting for
21 Mark to join us, I can second the remarks made by the
22 representative from Laclede. Obviously, this issue of

1 the cost of the units is absolutely foundational to
2 an assessment of whether this rule is economically
3 justified. We respectfully request that, given the
4 central nature of this question, that all information
5 pertaining to that decision simply has to be in the
6 public domain for us to be able to reasonably assess
7 the validity of that information.

8 It seems unreasonable to us that the
9 Department would not be willing to provide that.
10 Without it, we are not able to assess the rule in a
11 meaningful way.

12 MR. BROOKMAN: Okay, thank you. Ashley
13 Armstrong? No. We have a couple of additional --
14 I'll go back to Mark since we are on this stream and
15 then to you, Andrew.

16 MR. KREBS: Jim Moore has his hand up. I
17 suggest you answer him.

18 MS. ASHLEY: Well, why don't we let Karen
19 speak for a second.

20 MR. BROOKMAN: Go ahead, Karen, please.

21 MS. MEYERS: Karen Meyers with Rheem, and
22 we would highly object to all the parts and pieces of

1 our units being made available. However, should you
2 wish to go purchase them and do your own teardown
3 analysis, we will be happy to sell you a unit, but you
4 cannot expect that a manufacturer is not going to
5 object to a complete teardown analysis, essentially
6 making our bill of materials available online, many
7 of which is covered with patent protection and other
8 things such as that.

9 So that is to me a completely unreasonable
10 request.

11 MR. KREBS: Which raises the question, just
12 how transparent is this supposed to be?

13 MR. BROOKMAN: Okay, Mark, thank you. Now to
14 Andrew, I think --

15 MR. DELASKI: Let me just weigh in
16 briefly. DOE has published the manufacturer
17 production cost. What else do you need to know? Do
18 you need to know the cost of each screw? It doesn't
19 strike me -- For being transparent, the manufacturer
20 production cost is there. The retail price is there.
21 That's what affects consumers.

22 MR. BROOKMAN: Let's hear from Tom Archer.

1 Tom, you should now be able to speak.

2 MR. ARCHER: The comparison was because if
3 there is a two-stage non-condensing BPM product as
4 the baseline, no manufacturer sells that today, so I'm
5 wondering what teardown got us to the baseline cost
6 of that furnace.

7 MR. BROOKMAN: Adam.

8 MR. DARLINGTON: I missed part of it.

9 MR. BROOKMAN: Tom, you need to repeat the
10 first half of your question, all of it in fact.

11 MR. ARCHER: My question is, if the
12 baseline utilized for the analysis is a two-stage
13 non-condensing constant-torque BPM furnace, it's
14 basically a two-stage X13 80% furnace. No
15 manufacturer has that today, so I'm wondering what the
16 baseline cost is in order to get from that two-stage
17 constant-torque BPM or two-stage X13 80 to a two-stage
18 X13 90, and at the same time, we said the minimum is 92,
19 so if we go from a furnace that doesn't exist on a
20 non-condensing two-stage X13 80 to a two-stage
21 condensing 92 X13 that doesn't exist either, so the
22 two furnaces that we are tearing down and getting a

1 cost analysis on are not existing by any of the
2 manufacturers today.

3 MR. BROOKMAN: Adam, can you address that?

4 MR. DARLINGTON: Well, yes. So, I mean, the
5 way the analysis was done, and I'm not 100% sure that
6 that's totally true that no manufacturer makes those,
7 but basically, yes, we do have adders, so we added the
8 cost of swapping out the components, so basically, if
9 you had a PSC motor, you know what's the cost and
10 what's the changeover because we looked at
11 specifically manufactured products with X13 motors
12 and with fully ECM motors to determine the
13 difference, not only to the motor but to the controls
14 and other components as well.

15 And so looking at that incremental cost
16 allows us to tabulate the cost, if those components
17 were present.

18 MR. BROOKMAN: Karen, do you wish to
19 comment here?

20 MS. MEYERS: I just would like to comment
21 that I disagree with the statement that none of those
22 furnaces exist in the market today.

1 MR. BROOKMAN: Okay, thank you. You
2 standing there, would you like to comment? Please say
3 your name for the record.

4 MS. SHEPHARD: My name is Amy Shephard
5 from AHRI, but my comment is not directly on this
6 point, so if we want to finish this

7 MR. BROOKMAN: Okay thank you, Mike
8 Rivest?

9 MR. RIVIST: Mike Rivest, Navigant. Again
10 I wanted to state that we want to be helpful. If the
11 request can be scoped to focus on the information
12 that is required to make the determination that the
13 costs are reasonable -- so for example, the cost of
14 the secondary heat exchanger in this case, which seems
15 to be an important component, I mean, we can provide
16 that in an aggregated way for different products that
17 you know we do have serious concerns about -- the
18 proprietary nature of the data.

19 MR. BROOKMAN: Yes, Kathryn?

20 MS. CLAY: I would strongly suggest that
21 it undermines the integrity of the Department's
22 process to be relying on proprietary data. There is

1 a solution here. If you are not able to release the
2 data, don't rely on it for the assessment.

3 MR. BROOKMAN: Okay, we have a comment from
4 Mark Nayes who is joining us online. Mark, hopefully
5 you will be unmuted now.

6 MR. NAYES: Yes, as far as the cost
7 analysis of the breakdown of the furnace, we don't buy
8 broken down furnaces. We buy them all assembled
9 together already, and our cost on an 80% PSC motor
10 furnace can be as low as \$350.00. For the 98% ECM
11 furnace, it can be anywhere from \$1,800.00 on up,
12 depending on size.

13 We buy from three different manufacturers,
14 so we have got a pretty good analysis across the
15 spectrum of who makes furnaces.

16 MR. BROOKMAN: And Mark, who do you
17 represent?

18 MR. NAYES: We are Southside Heating and
19 Air Conditioning, Incorporated, out of Bloomington,
20 Minnesota.

21 MR. BROOKMAN: Thank you.

22 MR. RIVEST: This is Mike

1 Rivest. I think what's been lost in all of this, and
2 the primary reason that we couldn't rely entirely on
3 rebuild data, is that the volumes that we are talking
4 about here shifts the entire market from the current
5 minimum standard, so the market right now is a mix of
6 80's and 92's and 95's, and so in this example, 98
7 represent 2% of the market.

8 In the world where if the minimum standard
9 were 98, a 98% AFUE furnace would not cost \$1,800.00.
10 Everyone would be producing at high volume 98% AFUE.
11 The production processes would be optimized, economies of
12 scale would come in, so that \$1,800.00 price point is
13 no longer relevant, so we have to rely on an
14 understanding of the technologies of the
15 manufacturing processes. That's why this is the type
16 of analysis that is required.

17 Now, I think there could be useful retailer
18 information where the volume's average could collect,
19 you know, so Karen's idea of looking at Home Depot is
20 certainly valid where there is significant sales
21 volume but at 98.

22 MR. BROOKMAN: Neil?

1 MR. LESLIE: It raises I guess one of the
2 key questions I would have related to some of this,
3 and that is at what point do you consider the
4 different technology options to be at maturity?

5 MR. BROOKMAN: Harvey Sachs?

6 MR. SACHS: This is Harvey Sachs from
7 ACEEE, and what I am sensing here is to force the
8 discussion into a blind alley where nothing can be
9 done because we are at the intersection of
10 proprietary information and demand for increased
11 public information and that's in some sort of a NDA,
12 non-disclosure agreement. I am sensing, and I hope I
13 am wrong, an effort to discredit the entire standard
14 setting process for this and other products, rather than
15 an effort to explore whether the end result is,
16 Andrew's suggestion, the true MPC and the true average
17 retail price for volume products, but that's really
18 the issue. Thank you.

19 MR. BROOKMAN: Ashley Armstrong?

20 MS. ARMSTRONG: So we just have a question
21 from the web, and so, Adam, I'm going to read it. It
22 comes from Everett Shorey, and he wants to know, how

1 did you extrapolate from your 80,000 BTU unit to
2 other sizes, and how did you deal with the larger
3 capacities that come out of your further downstream
4 analysis? So if you could explain your extrapolation a
5 little bit, that would be great.

6 MR. DARLINGTON: Yes, as I mentioned during
7 the selection of teardowns, we selected units above
8 and below our representative capacity as well, so we
9 compared those units to the representative capacity --
10 what changed, how things changed, you know, how the
11 heat exchanger sizes changed, how the components
12 changed, you know, does it need a larger inducer,
13 does it use the same inducer fan, et cetera.

14 Does the cabinet get larger, and basically
15 then what we did was we estimated the cost difference
16 to change the size based on which components would
17 change in larger and smaller units, so we accounted
18 for, you know, if it has a larger cabinet or a smaller
19 cabinet, if it has a larger heat exchanger, and which
20 components are the same so that when you have a
21 changing cost between sizes. So that was basically our
22 methodology there to estimate those costs.

1 And then they were fed into the LCC so

2 MR. BROOKMAN: I'm eager for us to keep
3 going as you contemplate your next set of questions.
4 Keep going, Adam.

5 MS. ARMSTRONG: Do you want to bring up
6 your --

7 MS. SHEPHARD: Yes, I will bring up a point,
8 so I can just make it and then step back. And mine
9 goes back to Frank's point about the test procedure.
10 The DOE Process Rule has certain key elements in it,
11 and one of them is the sequence in which the test
12 procedures relate to the standards that are being
13 developed.

14 And in that Process Rule, it says that the
15 test procedures will be determined before the NOPR
16 stage of the standard, and that's so [that for] the analysis
17 that
18 is used, we know how you are measuring it. You know
19 what the effects are, and I appreciate the conversation/
20 discussion yesterday and additional information that
21 is coming out, but when you don't have the measurement
22 finalized and that's what you are using to develop

1 the standards, there's an increased level of
2 uncertainty and, I think, unfairness to folks, and so I
3 would encourage that the test procedure for this needs
4 to be finalized in accordance with DOE's own Process
5 Rule.

6 And understanding that we have timelines
7 and that those timelines are based on DOE's best
8 efforts, we appreciate the work that is being done,
9 but it is very important to have that process which
10 has been broken down, and [there are] a lot of DOE rules
11 where you
12 don't have the test procedures correlated in this
13 manner. It needs to start now complying with the
14 Process Rule where we have that done before we use it
15 to analyze these standards.

16 MR. BROOKMAN: Okay, thank you. Mark, do you
17 want to follow on?

18 MR. KREBS: First of all, what she said.
19 Second of all, Jim Moore still has his hand up. I urge
20 you to recognize him.

21 MR. BROOKMAN: Yeah, I didn't receive that.
22 Jim, go ahead and speak. I can't hear you. Here we go.

1 Now you go.

2 MR. MOORE: Many people touched on most of
3 my concerns. The one that I think originally was and
4 Mark said a little, what mode of pricing did you
5 assume? You tore this thing down with a PSC in it,
6 and then you came up with some kind of a price for
7 these more complicated motors which have maintenance
8 issues and high costs, and I was just trying to figure
9 out -- I don't even know the price variables -- I was
10 trying to figure out what you assumed for the price
11 of the fan motors [that] was my original question.

12 MR. DARLINGTON: Yeah, Adam -- this is
13 Adam, so we -- the prices that we assumed for the fan
14 motors, they were based on some of the analysis that
15 was done for the furnace fans rule. As I mentioned,
16 the requirement for the X13 constant-torque BPM and
17 that came out of the furnace fans rule, so those are
18 actually available, both in that rule, and, I believe,
19 we put a table in the TSD that shows what the cost
20 difference would be, so that would be in chapter 5 of
21 the TSD.

22 MS. ARMSTRONG: So Mark, as a follow up, we

1 will get you the reference you need to look at the
2 fan motor pricing to specifically address this
3 question, and that should do it.

4 MR. BROOKMAN: Harvey?

5 MR. SACHS: Thank you. Harvey Sachs, ACEEE,
6 and I have a question for Amy -- follow-up for Amy. For
7 the manufacturers, would you all prefer that this
8 rulemaking were to proceed with the old AFUE rating
9 method with its own problems on these units? This is
10 being proposed as a patch from the old rating

11

12

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13

14 methods, like the water heater.

15 MS. SHEPHARD: Well, I think the key is the
16 process part of it. Yes, it should be fixed, and that's
17 final, that is, what you use to analyze the standard
18 and, I mean, I think that's why the Process Rule came
19 out of a very similar situation in the 90's where you
20 had a lot of these same issues going on, and I think
21 that what we are feeling is that they are still here,
22 and the Process Rule is the tool to address it.

1 MR. SACHS: This is Harvey again, and you
2 are being very skillful at not answering the question
3 that I asked.

4 MS. SHEPHARD: It should be fixed, and it
5 should be fixed for, well I -- as soon as we start
6 talking about test procedures, it gets so technical. , I
7 always defer to Frank so -- but what I am saying is
8 if there are issues that need to be addressed, they
9 are addressed. That is [made] final before the NOPR. That
10 is
11 what is used in the analysis.

12 MR. SACHS: It seems to me, and I really
13 would -- I certainly don't ask for this now, but I
14 really think that we are getting on in years since we
15 have had a new gas furnace rule, and the questions
16 were, is there something DOE could do that others
17 might be happy with, like say, "Gee, we will give you a
18 waiver to use the new one on the affected two-stage
19 units."

20 Is there something that could leave you
21 all whole that would not require putting the whole
22 rulemaking on hold for another year?

1 MR. BROOKMAN: Let's hear from Karen.

2 MS. MEYERS: Karen Meyers with Rheem, and I
3 think my answer at this point, Harvey, would be no. In
4 my opinion, this rulemaking should be -- we should hit
5 the pause button on it until the test procedure rule
6 is finalized in accordance with what is in the
7 statute, so that's the proper way to do it, and that is
8 the way we Y,ou know, Rheem itself have several issues
9 where this has caught us unaware in the past.

10 So I'm speaking for Rheem, not necessarily
11 the industry, but we would prefer to see test
12 procedures finalized and then the analysis take
13 place.

14 MR. BROOKMAN: Jim, go ahead.

15 MR. VERSHAW: Jim VerShaw, Ingersoll Rand.
16 I think if you look at the test procedure and the
17 discussions we had yesterday, a lot of work on what
18 the difference with the AFUE between the new
19 procedure and the old procedure. But when I ask
20 questions about what it did to burner operating hours
21 and blower run time hours, I didn't get an answer. I
22 didn't calculate that, and if you look at life-cycle

1 costs analysis for this thing, especially looking in
2 the south, a lot of air conditioning hours, what does
3 that do?

4 Do we really know what the new procedure
5 and if that is more accurate, did they account for
6 that when they did the analysis here, and I think we
7 really don't have a good answer on that, and that's
8 part of this discussion.

9 MS. ARMSTRONG: So, I do want to follow up on
10 one thing, because one of the things that we did
11 clarify yesterday, and I think Victor is going to
12 speak to it a little bit further when we get into the
13 LCC specifically, was that we did account for it in
14 this rule, so it is consistent, and we can provide you
15 the information at least with what we assumed in this
16 rule for those burner operating hours, and I think you
17 noted even yesterday that's what we did in the
18 previous rule too, just because it's a better
19 reflection of what is currently happening than what
20 is our current test procedure.

21 So we will get into that a little bit
22 later when we get into the LCC because there is a lot

1 of slides going on there and so, but the answer to
2 your question is yes, and we did somewhat address that
3 yesterday, and we are going to further and completely
4 address it today.

5 MR. BROOKMAN: Thank you, Ashley. Mark?

6 MR. KREBS: Yeah, I have the same concerns
7 about homes in the south, and in doing some research
8 on that, I came across two papers from LBNL and the
9 lead author, Victor Franco, was in the room, and
10 he might be able to elaborate significantly on your
11 questions and fill us all in on that issue. Thank
12 you.

13 MR. BROOKMAN: Okay, we are going.

14 MR. DARLINGTON: All right, so we will move
15 on. All right, another aspect of this rulemaking is
16 the standby and off mode analysis. DOE analyzed a
17 single standby mode and off mode standard, and the
18 reason for this is that furnaces are typically used
19 along with a cooling system during the non-heating
20 season, so the furnace wouldn't be completely powered
21 off, but it will remain in standby mode for a cooling
22 demand, at least for the --

1 MR. BROOKMAN: Steve Rosenstock?

2 MR. ROSENSTOCK: Steve Rosenstock, Edison
3 Electric Institute. Just a couple of quick questions,
4 and if it was in the technical support document,
5 please forgive me. For these components, what was
6 the -- I know you are assuming that the numbers shown
7 was energy consumptive combination, what was the
8 range of values for the components?

9 MR. DARLINGTON: I don't know off the top
10 of my head. I could probably look at it and get back
11 to you.

12 MR. ROSENSTOCK: Okay, the
13 second question I have was when we tested and what
14 was the testing equipment accuracy?

15 MR. DARLINGTON: I would again have to
16 look at that. So we tested in accordance with
17 whatever DOE's test procedure is, so I think it
18 references the IEC standard, and we used equipment
19 within the accuracy.

20 MR. ROSENSTOCK: Steve Rosenstock, EEI.
21 When we get to the next slide I will have some
22 follow-ups because I think that's very important in

1 terms of some of the numbers.

2 MS. ARMSTRONG: This is
3 Ashley from DOE, and like Adam says, we can go back and
4 look at those. Typically, we use Yokogawa, Yokogawa but we
5 can
6 go back and see exactly what we used.

7 MR. ROSENSTOCK: Steve Rosenstock, EEI.
8 Thank you very much, but I really kind of wanted to
9 focus in on what the accuracy of the equipment was so that
10 I can plus or minus 5% of it or plus or minus --

11 MS. ARMSTRONG: If you look up that actual
12 test equipment, it will give you those accuracies that
13 will answer your question.

14 MR. ROSENSTOCK: Steve Rosenstock, thank
15 you, but okay, I'll make another comment when we get to
16 the next slide. Thank you.

17 MR. BROOKMAN: Okay, go ahead, Adam.

18 MR. DARLINGTON: So going back to what I
19 was saying, we did it as a design option approach. DOE
20 established a baseline based on product test data
21 along with manufacturer feedback, so currently there
22 are no ratings, at least that I am aware of, for the

1 power consumption in standby mode. So the baseline
2 efficiency levels were just defined as the most
3 consumptive combination of electrical components for
4 the tested furnaces, and then specific design options
5 were applied to the baseline in the order of cost
6 effectiveness, and here on the side, you can see what
7 we found to be the key driver of the standby mode
8 consumption, which were: the transformer, if a BPM
9 blower motor is present, and, of course, that factors in,
10 and then controls and just other standby consumption
11 with the unit.

12 So total baseline was 11 watts -- so here
13 on this slide, we are representing our results
14 basically at the baseline and the linear power
15 supply and the standard 40 VA transformer. Efficiency
16 level 1, adding in a low-loss transformer.
17 Efficiency level 2, going to a switching mode power
18 supply, and then at efficiency level 3, adding units
19 switching on the power supply in the low-loss
20 transformer, and that gives you the estimates here of
21 what the standby/off mode power consumption would be
22 as it compares to the baseline, along with the

1 estimates of what that would cost to implement.

2 MR. BROOKMAN: Steve Rosenstock?

3 MR. ROSENSTOCK: Steve Rosenstock, EEI, and
4 here's my point. If whatever the standard test
5 equipment accuracy is, let's say it's plus or minus
6 five percent, well now we are down to tenths of a
7 watt here for this efficiency standard. 9.5 plus or
8 minus 5% is now .5 watts, so, and again it also depends
9 on the range of products out there.

10 You go from efficiency of that baseline to
11 efficiency level 2 or 3, and based on the range of the
12 accuracy of the test equipment, you may or may not be
13 saving any watts whatsoever. Especially going from
14 efficiency level 1 to 2, you are talking about a .3
15 watt difference.

16 And the testing equipment is plus or minus
17 5%. Well, you might be saving electricity; you might not
18 be, because there is going to be a range depending on
19 the product and depending on the design, so again I
20 think when you are talking about such miniscule
21 savings, you know, you have to account for something,
22 what's happening in the test equipment, and especially

1 if there is a lot of baseline equipment, when you talk
2 about lost energy consumption, if the typical one on
3 the market is already at 9 watts, you know, some people
4 might be saying you are spending ten dollars to save
5 0.0 watts, excuse me. Thank you.

6 MR. BROOKMAN: Adam, to the comment box
7 please.

8 MR. DARLINGTON: So DOE is seeking your
9 comment on basically any aspect of the standby mode
10 analysis, and what fraction, if any, consumers shut off the
11 furnace during the non-heating season. Your comments
12 are welcome.

13 MR. BROOKMAN: And then the second one
14 relates to any other issues related to methodology,
15 assumption, or results of the standby mode or off mode
16 engineering analysis and all of the foregoing slides.
17 This would be a good place to register any additional
18 thoughts or concerns. Frank Stanonik?

19 MR. STANONIK: Frank Stanonik, AHRI. And
20 seeing that sentence, I can't tell you how many times
21 about whether consumers shut off during the heating
22 season, and I just have a new question. Aren't we

1 really just talking about furnaces that in fact are
2 not also driving the air-conditioning system, the
3 cooling system?

4 Because if you have a furnace, whatever
5 percentage of homes have both a furnace and an air
6 conditioner, I would say that question doesn't even
7 apply because the system will always be on 24/7 365.
8 So I guess my point is, is that question really only
9 looking at those installations where the household
10 only has a furnace, heating and cooling?

11 MR. DARLINGTON: So that's our thinking too,
12 is that it should be on all the time to be on standby
13 for a call for cooling. So the furnace fan standard, I
14 don't think it addressed standby mode at all because
15 DOE had already proposed back in the 2011 direct
16 final rule to cover the standby of the entire furnace,
17 so I guess it can be a little confusing because the
18 active mode of the furnace fan was covered by the
19 furnace fan and stated, whereas the standby mode is
20 going to be covered by this.

21 So this covers the entire furnace
22 regardless of whether it is a furnace only or whether

1 it is installed with an AC, and the understanding is
2 that almost all furnaces would be -- the vast
3 majority at least, would be installed with an AC, so
4 there would be no distinct off mode. It would be in
5 standby mode year around, so that's kind of what we
6 were --

7 MR. BROOKMAN: Frank, go ahead.

8 MR. STANONIK: I think Adam just said they
9 had them, and now I am asking, so why are we asking
10 this question then?

11 MR. DARLINGTON: Just to confirm to confirm
12 our assumption.

13 MR. ARMSTRONG: Frank, you can say you
14 agree with the Department, it is okay. It is a rarity,
15 but yesterday we agreed too.

16 MR. BROOKMAN: Kathryn?

17 MS. CLAY: As we leave the engineering
18 analysis portion, I just wanted to circle back to our
19 earlier discussion on costs, and I appreciate Harvey's
20 framing of the issue as a balance between protecting
21 proprietary information and protecting the right of
22 the public to be able to analyze it.

1 Call me a crazy optimist, but I just
2 can't help to believe that there is a way to solve
3 that problem and find a middle ground. I can imagine
4 ways of providing some intermediate level of
5 information either by chunking components into
6 systems so you obscure the individual component
7 costs, or the ended averages across costs for
8 manufacturers but something in between absolutely
9 nothing -- this black box that we are looking at -- and
10 full-on proprietary information data to the last
11 screw.

12 There's got to be some reasonable
13 information sharing approach that we could come up
14 with working together, and we just appreciate the
15 chance to work with you all to find that solution.

16 MR. BROOKMAN: Ashley Armstrong?

17 MS. ARMSTRONG: Sorry, I think that's
18 something that Mike alluded to earlier when he was
19 speaking, so I think what would be helpful to the
20 Department, or We are definitely willing to work with
21 you. Obviously, we want to make our analysis as
22 transparent as possible, and we are really in this to

1 get feedback and incorporate that feedback, so to the
2 extent that there is certain information that you are
3 seeking, like for example, they asked for -- Laclede
4 asked for motor pricing, that kind of stuff that we
5 used in our analysis on -- I think we would welcome
6 that, and if you want to have a conversation further
7 with some of the manufacturers about what level of
8 aggregate DOE would be comfortable with, and we would
9 do it on an aggregate industry basis not on a model
10 basis by any means.

11 I'm happy to have that conversation, and
12 feel free to follow-up.

13 MR. BROOKMAN: Okay. Additional comments?
14 Here, Jim, please.

15 MR. VERSHAW: Jim VerShaw, Ingersoll Rand.
16 You know, I am looking at this switching mode power
17 supply that adds \$8.00 manufacturer's cost to save 23
18 watts or that plus a low-loss transformer for another
19 \$9.67 to save a watt. As a standalone, would that make
20 sense for the consumer? Because that is going to add,
21 what, thirty dollars to the homeowner's cost to
22 install the furnace, and it goes to a technology that

1 none of us have experience with in terms of putting
2 it in our product.

3 And if you have a furnace, the last thing
4 you want is some kind of new technology that is going
5 to go out when it is 30 below zero up in Minnesota or
6 even 18 in Texas. I mean, there [are] a lot of unknowns
7 in there to save, and it says it saves a lot but to
8 Steve's point, it kind of overlaps. [Are] there really
9 savings there, and is it really worth that kind of
10 money with that kind of unknown or reliability to put
11 that in? That's my feeling on it.

12 MR. BROOKMAN: Thank you. We are due for a
13 break, let's take a break. It's 10:55 by that watch
14 up there. Let's take 15 minutes. Just to remind you, I
15 think most of you are familiar, please wear your
16 badge visible. The restrooms are on both ends of the
17 hall. If you are going to go for coffee, it's on the
18 ground floor. Go quickly.

19 MR. BROOKMAN: Apologies for starting a
20 few minutes later than scheduled. It was truly
21 clogged up in the coffee shop. Just waiting to make
22 sure everybody got back here before we commence. So

1 we are going to pick up where we left off and begin
2 with the life-cycle cost analysis, and we are going to
3 hear from Victor Franco.

4 MR. FRANCO: Thank you, good afternoon.
5 My name is Victor Franco. I am from Lawrence Berkeley
6 National Laboratory, and I will be speaking about the
7 life-cycle costs analysis and the subgroup analysis in
8 this next section.

9 So this slide shows the overall payback
10 period and LCC analysis, a flow chart about the
11 analysis. Obviously, the analysis is pretty complex
12 because of all of the inputs, and I just want to go
13 over it a little bit in detail to try to set up the
14 discussion for the next few slides.

15 So first of all, as we discussed earlier in
16 the engineering analysis, we come up with a
17 manufacturer cost. We have discussed that already.
18 In chapter 6, we describe the markups to determine the
19 product prices, and that's how we come up with a
20 consumer price. We add this to the installation
21 costs, which we will discuss later, to come up with the
22 total installed cost.

1 In terms of the LCC and payback, we have to
2 consider the differential between the base case and
3 the standards cases, and that gives us these
4 incremental costs, which is the slide above. In the
5 bottom cells, we describe the operating costs.
6 Chapter 7 describes the energy use characterization
7 to determine the energy consumption. We then
8 multiply those by the energy prices to come up with
9 annual operating costs in terms of energy.

10 We also consider repair and maintenance
11 costs to come up with the annual operating costs.
12 Again, we come up with these incrementals to come up
13 with these annual operating cost savings between the
14 standard cases and the base cases. Other inputs to
15 the LCC analysis include lifetime discount rate and
16 energy price trends.

17 With this, we come up with a discounted
18 lifetime operating cost. The total installed cost
19 incrementals and the discounted lifetime operating
20 costs are the main inputs into the life-cycle cost.
21 The total installed cost and the annual operating cost are
22 the main inputs to the payback period.

1 In addition to this, we have product
2 switching that is incorporated into the LCC analysis.
3 That's the box shown right above the payback period
4 and life-cycle costs analysis, and we will be
5 discussing all of these in subsequent slides.

6 First, let me go over a little bit more
7 about just the overall LCC calculation. So first, it
8 is important to note that the LCC provides an
9 economic evaluation from the consumer perspective, so
10 that's why we are looking at this in terms of
11 household by household or furnace by furnace.

12 The life-cycle cost is a total consumer
13 cost over the life of the product. This is shown in
14 the equations that are shown below. The payback
15 period is the time to recover the increased purchase
16 price of the higher-efficiency products through reduced
17 operating costs. We used a sample of households and
18 we will be describing in more detail later [how] to do this
19 analysis.

20 The equations are shown here. The
21 analysis models with the uncertainty and variability
22 of inputs using the Monte Carlo approach and the

1 probability distributions using Excel spreadsheets
2 which uses a Crystal Ball add-on.

3 In the next slides, I will fully explain
4 the approach applied to generate the inputs and the
5 probability distributions. The spreadsheet inputs
6 and the application method -- this will also be a
7 good opportunity to answer any questions about the
8 analysis methods in the LCC spreadsheet.

9 This is next slide. I won't go through it
10 in detail. It is just for the purpose of summarizing
11 all the different inputs, and you can use this as
12 notes as we go through the discussion. Basically, we
13 will be going through all these different inputs in
14 the order in which they are shown on this slide, so
15 first, we will be describing the total installed cost
16 which includes the consumer product price and the
17 installation cost.

18 Then we will be talking about the
19 operating costs, which will include the energy use,
20 energy prices, maintenance and repair costs. Then we
21 will talk about the other inputs for the LCC analysis,
22 including the discount rates, lifetime, base-case

1 efficiency distributions.

2 For this analysis, the LCC tools include
3 product switching, and that will be described further on
4 as well.

5 MR. CYMBALSKY: So this is John from DOE.
6 If people want to pull this slide out from the rest
7 of them because I think this is a good cheat sheet as
8 we go through when Victor describes the different
9 analyses. This is a good map -- key map for the
10 concepts that will be discussed, so

11 MR. FRANCO: Thank you, John. So this is
12 Victor Franco again. First, then, we will be
13 discussing the product price determination. The
14 product prices are determined by multiplying the
15 manufacturer cost by the markups, which will be fully
16 described on the next few slides, and the price for
17 manufacturer.

18 As we discussed earlier in the engineering
19 analysis, the manufacturer production costs are
20 developed for each efficiency level. The markups are
21 derived from company direct costs, expenses, and profit.
22 The consumer price is based on MSP for the baseline and

1 higher-efficiency products.

2 We characterized the non-weatherized gas
3 furnace and mobile home gas furnace distribution
4 channels, and we will be describing that in more
5 detail in the next slide.

6 The price trends on the historical PPI
7 data are based on the historical PPI data and
8 shipping data. The price trend is a decreasing -- it
9 decreases about 16.5% over the 30-year analysis
10 period. The 30-year analysis period starts in 2021
11 and goes until 2050. We also consider sensitivity
12 analyses of other trends: a high decreasing -- a higher
13 decreasing rate and a constant trend, and those are
14 provided.

15 MR. BROOKMAN: Neil, please go ahead.

16 MR. LESLIE: I'm going to try to re-ask a
17 question. I'm sorry, I'm Neil Leslie with Gas
18 Technology. Excuse me. , I apologize for that. So a
19 little bit ago, I asked a question that related to at
20 what level of shipment for a particular product, such
21 as a 92% furnace, would it be considered a mature
22 product, and so I'm going to re-ask this in context of

1 the default price trend which seemed to be
2 decreasing, a decreasing price trend over time.

3 And my question is, and I'm not sure who is
4 going to be able to answer this question, how many of
5 the products at the different trial standard levels
6 are deemed to be mature products, such as the 80%
7 product, whose market share has been declining over
8 time remains considered a mature product?

9 Does the 90%, does the 92%, does the 95%,
10 and does the 98% furnace also qualify as a mature
11 product? If so, what would the rationale be for a
12 decreasing price trend, and if not, why not?

13 MR. FRANCO: Thank you for that question. I
14 would have to defer that to my colleagues.

15 MR. CYMBALSKY: This is John from DOE. Let
16 me just take a stab at the context of learning that
17 you bring up here. So what we did here is we looked
18 at furnaces generally, so I guess going back to
19 Andrew's opening remarks, maybe we can rephrase your
20 question in terms of is there -- do you believe there
21 should be no learning for the whole market or do you
22 believe that furnaces should be just aggregated by

1 the AFUE levels to pick out which ones could
2 experience more learning relative to the others?

3 So I guess when we put that back on to
4 what your thinking is, and then we can better answer
5 the question.

6 MR. LESLIE: Ultimately it will go to --
7 this is Neil Leslie -- ultimately it will go to the
8 price trend for the different trial standard levels
9 for each of the individual trial standard levels, and
10 so if indeed there is no distinction among the trial
11 standard levels related to what I would call a
12 learning curve, then my question is, and this is where
13 I am back to it, would that imply then that DOE is
14 assuming that these are all at fairly mature levels
15 of shipments?

16 MR. CYMBALSKY: No, so I think what we are
17 saying is, based on the data that we had, we created
18 one trend for all the whole furnace market, and so I
19 guess to interpret your question, it sounds like if
20 the level of shipments for say in 98 are much lower
21 relative to an 80, we should have faster learning on
22 the 98 than we should the 80, is that a yes?

1 MR. LESLIE: I'm not suggesting what is
2 correct. I just wanted to know what you have.

3 MR. CYMBALSKY: Right, so it's the same
4 and we have been consistent with all of our rules
5 that we applied the learning equally amongst all the
6 technologies. We don't have faster learning in the
7 lower shipment AFUEs in this example. Same for all
8 of the products, but we understand where you are
9 coming from. If we had the data that could support
10 better disaggregation, we are all for taking it in.

11 MR. BROOKMAN: Mark?

12 MR. KREBS: Mark Krebs, the Laclede Group.
13 John, as I recall from the DFR, you had a significantly
14 faster learning for gas furnaces than you did for air
15 conditioners, so you know, consider that that is a fact,
16 and although this NOPR is just about furnaces you
17 know, I would say that you haven't been consistent.

18 MR. CYMBALSKY: No I think -- John
19 Cymbalsky, DOE. The methodology has been consistent.
20 The actual trends are different based on the data for
21 each product, so I don't know off the top of my head
22 what the air conditioner one was, but for example, we

1 have another rule where we look at the data -- same
2 data source but for the different product category
3 out of the data set -- and there was no learning.

4 There was no observed learning. I'm not
5 saying its air conditioners but so it all depends on
6 the product. The methodology is consistent.

7 MR. KREBS: Well, I would suggest that it
8 is just another area of controversy that we should
9 probably do without even attempting to factor in
10 learning curves.

11 MR. BROOKMAN: Andrew deLaski?

12 MR. DELASKI: Well doing without it is
13 doing without the data. I mean, it's based on a model
14 and data, it's not based on just an opportunity --
15 from a hat and that's really -- I applaud the Department
16 for coming up with a statistically-driven model that
17 is based on economic literature that is used not just
18 in DOE rulemakings but in other economic analysis for
19 how products evolve over time.

20 So I applaud DOE for having the data-
21 driven model. I think the challenge is what Neil put
22 his finger on, which is how you apply it to the level

1 that the new standard will be and I encourage the
2 Department to continue to explore approaches that
3 will allow you to develop learning for the
4 incremental technology. The learning concept is
5 driven by for each doubling of production -- of
6 cumulative production, there is a certain rate of
7 learning.

8 So doubling the cumulative production
9 should be applied to the particular product at the
10 level at which the standard is set, so yeah, I think a
11 lot of learning -- 80% -- has been done but I don't think
12 that as much learning has been done at the higher
13 efficiency level, so the question is, how do you
14 capture that in a statistically driven market? But
15 let's not ignore the data, let's find out how we can
16 use the data to answer that question which I think is
17 a relative question from docket.

18 We do have the data and it is in the TSD.
19 There's a whole chapter that writes this up quite
20 clearly over a pretty good time series data. I think,
21 thanks to AHRI, I think it is the source on the data,
22 one thing that's happening with that data is that the

1 tail end coincides with some pretty rich tax credits
2 that were applied.

3 And those tax credits were intended to
4 distort the market, they were intended to try to
5 change consumer behavior market distortion. And the
6 tax credits, I would submit, likely had an effect on
7 prices. Tax credits -- the benefits for tax credits --
8 are shared among consumers and manufacturers. Some
9 of those costs are passed on to consumers in lower
10 prices, but some of those costs, some of those credits
11 end up in enabling prices to stay higher than they
12 otherwise would.

13 So I think DOE needs to think about how
14 you disaggregate the effect of the tax credits from
15 what the tax credits were in the learning rates on
16 the price trends over time. I don't have an answer
17 for you right now how to do that but I think it's
18 something that we need to think about to get a better
19 estimate of what the actual learning was.

20 MR. BROOKMAN: Kimberly Swanson, who is
21 joining us online, has a question or a comment.
22 Kimberly you are now unmuted I think. Nothing from

1

2

113

3

4 Kimberly. Maybe you can join us in a moment.

5

6 We also have a comment from Everett Shorey,
7 who is joining us online, actually a question. He
8 says, figure 8J31 of the TSD seems to show that the
9 price trend is flattening and is not consistent with
10 the fitted curve. How have you factored that into
11 your analysis?

11

12 MR. FRANCO: Thank you for that question.
13 We used that part to -- we fit basically, we do the
14 best fit to that curve, and, as discussed earlier, part
15 of those values are distorted by the market, but we
16 use a longer period of time to come up with the
17 learning rate that should wash out some of those
18 distortion markets.

18

19 MR. BROOKMAN: Harvey Sachs?

19

20 MR. SACHS: Harvey Sachs, ACEEE, and Andrew,
21 I believe the data that you referred to were not from
22 AHRI but from the Census Bureau Producer Price Index,
so a very small thing. The broader point that I feel

1 is important to bring up is that for the first couple
2 of decades of these standards, the process DOE did not
3 incorporate learning curves in any significant way
4 that I can remember.

5 It's been asked for, for the last decade,
6 and has been incorporated. To me, the reason that it
7 was necessary to include learning curves is that
8 DOE's forecast of the retail prices of all sorts of
9 things without that were consistently too high for
10 almost every product analyzed retrospectively.

11 DOE had predicted a higher price for what
12 would after standards become the baseline product
13 than was actually observed. So the learning curve
14 approach can be argued about in the details but we
15 feel it was an essential compensation reflecting the
16 shift of what had been a niche product into one that
17 was built on the best processes with the newest
18 production processes, and it was a reflection of what
19 actually happened in the market for a range of
20 products, from dishwashers to whatever.

21 MR. BROOKMAN: Thank you. Go ahead.

22 MR. FRANCO: Thank you. This is Victor

1 Franco again. Let's move on now to more detail about
2 the markups analysis. Markups are used to determine
3 consumer prices for manufacturer's selling price for
4 both baseline and high-efficiency equipment, as
5 discussed earlier. The appropriate markups will
6 determine the consumer equipment prices that depend
7 on the type of distribution channels to which the
8 equipment moves from manufacturers to purchasers.

9 And on this slide you can see the
10 different distribution channels. At each point in
11 the distribution channel, companies mark up the price
12 of the equipment to cover the business cost and
13 profit margin. There is one primary type of
14 distribution channel that is describing the way most
15 products pass from manufacturers to consumers for
16 furnace products, from manufacturer to wholesaler to
17 mechanical contractor to consumer.

18 DOE also distinguishes between new
19 construction and replacement applications. The new
20 construction applications are expected to include the
21 general contract as shown in the diagram for
22 non-weatherized gas furnaces and includes for mobile

1 home furnaces, mobile home manufacturers and mobile
2 home dealers.

3 Based on information provided from
4 manufacturer interviews, there's another possible
5 distribution channel that includes the retail store
6 instead of the wholesaler -- in this case the
7 manufacturer sells equipment to the retailer who in
8 turn sells it to the mechanical contractor who in
9 turn sells it to the consumer.

10 However, DOE does not have enough
11 information at this point to make a separate market
12 estimate for this distribution channel. DOE assumed
13 that the retail markup is similar to the wholesale
14 markup.

15 The table below provides the references
16 used in the analysis. These references include
17 information for the manufacturer markup as discussed
18 earlier from the Security and Exchange Commission 10K
19 report. This is discussed in the engineering analysis.

20 The wholesaler markup comes from data from
21 HARDI 2012 profit report. The mechanical contractor
22 comes from two sources, ACCA data in the 2005

1 Financial Analysis and U.S. Census 2012 -- 2007

2 Plumbing and HVAC Contractors sector.

3 The general contractor comes from 2007

4 Consumer -- Commercial Building Construction sector. For

5 mobile home manufacturer and home dealer, both come

6 from U.S. Census Bureau data. Sales taxes come from

7 2013 Sales Tax Clearinghouse Data.

8 MR. BROOKMAN: Yes please?

9 MR. MCCRUDDEN: Charlie McCrudden, ACCA.

10 Your depiction of the new construction -- you have

11 the mechanical contractor come before the general

12 contractor? Does that suggest that the wholesaler is

13 providing it to the mechanical contractor and he is

14 subbing the general contractor? I'm a little

15 confused by that.

16 MR. FRANCO: Yes, thank you. It is a little

17 bit complex. Sometimes what happens is you go from

18 the wholesaler to how you are describing to the

19 contractor. The general contractor is the one that

20 connects with the consumer which in many cases is the

21 builder of the equipment so he would be the one that

22 actually marks up the whole equipment.

1 In other cases, it could be the general
2 contractor purchasing the equipment and then going
3 through the mechanical contractor, so it could be
4 either or. In terms of the actual value it would be
5 similar because you are just multiplying the
6 mechanical or the general contractor.

7 MR. BROOKMAN: Frank Stanonik?

8 MR. STANONIK: Frank Stanonik AHRI. I'm
9 not exactly fond -- but the general contractor, you
10 are using this Census Bureau commercial building
11 construction and I am going to ask -- I mean is -- I
12 understand those words to mean this is not a
13 residential building and so my first question is, is
14 that a correct assumption that this Census Bureau
15 report is in fact not covering residential buildings?

16 MR. FRANCO: Thank you. This is Victor
17 Franco. I think that actually is a misprint I think
18 that should say residential.

19 MR. STANONIK: So you did, okay so you
20 used the Census Bureau report on residential building
21 general contractor?

22 MR. FRANCO: That's correct, sorry about

1 that.

2 MR. BROOKMAN: Do you have an additional
3 question or comment?

4 MR. CYMBALSKY: I think -- this is John
5 from DOE. To address Charlie's question, to me, the GC
6 on this is, like Victor said, is kind of the home
7 builder in that case, right, so the home builder, if
8 they are building a bunch of town homes, they contract
9 with a mechanical HVAC guy to buy a bunch of them,
10 right. That's the way I see it, but if the order seems
11 backwards, we will take that comment, I think it's
12 correct too.

13 MR. BROOKMAN: Yes, Frank Stanonik?

14 MR. STANONIK: Frank Stanonik AHRI. I
15 think well, it is a little bit on point, I mean, and it
16 gets back a little bit to maybe this discussion of
17 price, and Andrew mentioned that in the case of
18 something like tax incentives or tax credits or
19 whatever distorts the market in both the -- or the
20 idea at least is the manufacturer and the consumer
21 shares on that.

22 And this reminds me but in fact -- and the

1 analysis, does this -- we need to keep this in mind,
2 okay, the ultimate cost the consumer pays they don't --
3 they, they don't buy the furnace from the furnace
4 manufacturer, okay, they are paying this installing
5 contractor and so the question -- let me rephrase this.

6 So even if we talk about tax credits and
7 the benefit of the tax credit, you really have to look
8 at, okay, so how does the installing contractor deal
9 with a tax-incentivized product? Does he in fact
10 change -- does he or she change the overall price to
11 the consumer? I mean, that's part of the equation,
12 and I would say we cannot ignore that because, as we
13 will see in many of the slides, that in fact, it is
14 very possible that the cost added by the installing
15 contractor is more than the cost of the product.

16 MR. BROOKMAN: Okay, Kimberly Swanson is
17 joining us online. Kimberly let's try it again, you
18 should be unmuted.

19 MS. SWANSON: Okay, am I coming through?

20 MR. BROOKMAN: Yes.

21 MR. SWANSON: I am Kimberly Swanson and I
22 am a consumer, and the question actually gets at

1 whether its analysis at all took into consideration
2 if the unit was going to be located in an area of the
3 country that had a carbon trading market or a
4 voluntary program within the market that the unit was
5 going to be located that worked to reduce carbon
6 emission.

7 MR. CYMBALSKY: This is John from DOE. We
8 are going to get to environmental impacts later, but
9 yeah, I think that gets all baked into the cost of the
10 fuel that it is in the EIA forecast, but we didn't get
11 to that level of specificity in this analysis, okay.

12 MR. BROOKMAN: Victor.

13 MR. FRANCO: Thank you again. This is
14 Victor Franco. Going further into the markup
15 analysis, DOE uses baseline markups and incremental
16 markups. The baseline markups relate the
17 manufacturers selling price or baseline equivalent to
18 consumer purchase price. DOE applied baseline
19 markups to the MSP at the baseline level.

20 Incremental markups relate to increase in
21 MSP of more-efficient products in the increase of
22 consumer purchase price. They cover only the

1 expenses that vary with MSP, such as operating
2 expenses and profit. Fixed costs such as overhead
3 and labor do not scale with increased efficiency.
4 DOE applied the incremental markups to incremental
5 difference in MSP at each level of the baseline.

6 This slide shows the overall markups
7 analysis, the average values. Obviously, we apply the
8 distributional values for each household depending
9 upon what region of the country they are located in.
10 As you see here, the manufacturer markups are 1.34 as
11 taken from the engineering analysis. The wholesaler
12 markups vary as shown. The mechanical contractor is
13 shown here as well, and then we have the general
14 contractor.

15 The average sales tax nationally is listed
16 here as 7% and the overall markups from this are
17 shown here. I just have here a correction there's a
18 national account that is not part of this analysis on
19 this table, just before questions the bottom shows
20 the overall average markup that's applied in the
21 analysis based on the fractional replacement and the
22 construction.

1 MR. BROOKMAN: Another question from
2 Everett Shorey online. Have you done any interviews
3 or collected any data from contractors and/or
4 wholesalers/distributors on their actual markup
5 practices?

6 MR. FRANCO: Thank you for that question.
7 We use ACCA data, which is a contractor's association
8 that gathers data from contractors and we also use
9 HARDI data, which gathers information -- aggregate
10 information from distributors. We have not contacted
11 directly individual contractors or distributors.

12 MR. BROOKMAN: Please follow on, say your
13 name.

14 MR. MURPHY: Yes. Rick Murphy, AGA. I would
15 like to go back to an earlier question I had
16 regarding the method of building up the retail price
17 and the process that is used, if you do a
18 reconciliation or a reasonable test to what your
19 results are with what is actually happening in the
20 market, in this case particularly on the market, I'm
21 sure we will get into a similar discussion on the
22 installation cost.

1 MR. FRANCO: Thank you so much for that
2 question. In the past we have provided a comparison
3 of retail prices that were found either online or
4 from distributors to the cost. In the case of this
5 analysis, it is a little bit more difficult because
6 the baseline starts with a much higher -- because of
7 the furnace fan standard, much higher, so it is hard
8 to compare baseline prices right now on the market to
9 the assumed baseline in this analysis because of the
10 furnace fan standard.

11 So we have done that in the past and our
12 results are similar to those either through the
13 retail prices kind of --

14 MR. MURPHY: So I believe in the TSD that
15 that differential between 80 and 92 based upon this
16 pricing is about \$172.00 or so and so we haven't been
17 able to determine how that relates to the actual
18 market with what we are seeing in the market today.
19 I'm not sure of the exact number but that is what I
20 recall.

21 MR. CYMBALSKY: I'm just looking at --
22 this is John from DOE -- so if my math is correct we

1 see the MSP markup at 1.21 and then to that you would
2 apply these factors, so that gets me into the several
3 hundred dollar, 350 --

4 MR. FRANCO: Yeah, this is Victor Franco.
5 I'm just looking at the TSD right now, so it's in
6 chapter 8, table 8.2.7, you can actually see the
7 values rise, the incremental from going from 80 to
8 90% is \$163.00 it's around what we gave you before.

9 MR. MURPHY: So we haven't been able to
10 evaluate that against what we are actually seeing in
11 the market for that increment?

12 MR. FRANCO: No, and it's complicated
13 because of the furnace standard.

14 MR. BROOKMAN: Frank Stanonik.

15 MR. STANONIK: Frank Stanonik, AHRI. Just
16 a follow up on what you just said. Okay, so in this
17 analysis, my baseline would still be the 80 with a,
18 what do you call an advanced motor, okay I will just
19 call it an advanced motor, and so also the 90 whatever
20 product is also going to have an advanced motor, so in
21 the analysis, in that case, for these markups other
22 than the manufacturers, are you using the baseline

1 markup or the incremental relative to the motor?

2 MR. FRANCO: So how we applied it in the
3 analysis, we apply it to the whole baseline so it
4 includes the furnace fan as part of the 80% level.
5 The incremental, which is just the condensing going
6 from non-condensing to condensing, is the incremental.

7 MR. BROOKMAN: Another question from
8 Everett Shorey. The question is -- I guess it's a
9 comment - well, there is a question and a comment. A
10 question from Everett Shorey -- so you have no data
11 to show that the incremental markup concept is
12 absolutely congruent with real practices in the
13 field?

14 MR. FRANCO: Thank you again for that
15 question. In the past when the comparison has been
16 more straight-forward, we have found that our analysis
17 matches with real data. Again, in this case, because
18 of the furnace fans the standard it is a little bit
19 more complicated, but we do assume that because it has
20 been consistent with the analysis in the past, our
21 analysis is consistent now. We will look in that for
22 more detail. Please provide comments.

1 MR. BROOKMAN: We also have a comment from
2 Mark Naves who says, the price of the installation of
3 our furnaces are based on costs, of which a tax credit
4 is not one. Our costs of installing a furnace is
5 typically 2 to 6 times the cost of the furnace.

6 Yes, Aniruddh?

7 MR. ROY: Aniruddh Roy, Goodman. So to
8 follow up on Frank's question, this analysis
9 essentially on the markup side does not account for
10 PSC motors.

11 MR. FRANCO: Just to clarify we are mainly
12 dealing with non-weatherized gas furnaces, that is
13 correct for non-weatherized gas furnaces. For mobile
14 home gas furnaces baseline, it is a PSC motor because
15 of the furnace fan standard but for non-weatherized
16 gas furnaces, you are correct.

17 So let's move on if there are any other
18 comments about the markup analysis or anything that
19 we discussed. So now let's move on to installation
20 costs. So this is obviously a part of the analysis
21 which includes a lot of inputs so I will go through
22 it as early as I can, please ask questions as we go

1 through this.

2 This flow chart is supposed to serve as an
3 introduction to the installation model. Again we
4 start with household sample. From that household
5 sample we determine location of that household and
6 other characteristics of the household. Based on
7 that, we use those characteristics to further
8 determine the installation costs for that household
9 individually as follows.

10 So first for the installation costs we
11 look at kind of starting for the right side of the
12 part, there are basic costs, installation costs -- these
13 are the green boxes -- venting installation costs, and
14 condensate withdrawal installation costs. The
15 condensate withdrawal would be mainly for condensing
16 for this, only for condensing purposes, and the venting
17 installation costs are related to non-condensing. We
18 will go into more detail about the venting costs. I
19 won't describe that area because I will describe it
20 more in a couple of more slides.

21 So these three components give us the
22 individual household installation costs. Our data

1 sources included RS Means to come up with these
2 costs, the Residential Cost Data Book from 2013 and
3 we have done this analysis in the past -- we also
4 reference 2011 DFR, the 2007 furnace and boiler final
5 rule, and we have -- we used manufacturer literature
6 as well.

7 So because it is an important component of
8 the installation cost, I will describe it a little
9 detailed with this flow chart how we determine the
10 location of the furnace. So first we have the RECS
11 household. RECS does not provide directly where the
12 furnace might be located, there is no question in
13 RECS that gives us that answer, but it does provide
14 what characteristics the household will have.

15 For example, it asks whether the household
16 has a basement, whether the household has an attic,
17 what year it was built, whether it has a crawl space
18 or a garage, so we use all of these characteristics
19 to try to come up where we would think the furnace is
20 located.

21 If a furnace is in the basement for
22 example it is assumed that if the household has a

1 basement for example we assume that the furnace is
2 located in the basement. In that example we also
3 have information from RECS that provides us whether
4 it is a finished or an unfinished basement and then
5 we use that information as well.

6 As you can see, we have different criteria
7 for the other parameters, indoor or a garage or crawl
8 space. This slide provides the result -- we have a
9 question?

10 MR. SACHS: Harvey Sachs, ACEEE. On your
11 attic bullet there is a term HH and I didn't catch
12 its meaning.

13 MR. FRANCO: Sorry about that, I tried to
14 go quickly through that slide. The HH is supposed to
15 represent household.

16 MR. CYMBALSKY: So we think this might
17 address question 4 in your installation question
18 relating to how does it account for installations
19 where more than one furnace is necessary.

20 MR. SCHROEDER: Closets not separated out.

21 MR. BROOKMAN: Dave, please say your name.

22 MR. SCHROEDER: Sorry, Dave Schroeder.

1 MR. BROOKMAN: I will repeat the question.

2 MR. SCHROEDER: So closet installations
3 are just installations that there is no
4 differentiation between closet and --

5 MR. FRANCO: That is correct, yes, for our
6 analysis we just use indoor and that does include
7 closet and other situations indoors. I just forgot
8 to mention to respond to the comment that for
9 households with multiple furnaces, a fraction of the
10 time the same household will be analyzed with the
11 furnace in the attic or indoors or in the closet in
12 the second floor. And another fraction of the time
13 the furnace will be analyzed as in the closet or
14 indoor space on the first floor or in another
15 location such as the garage. This would address that
16 question from HH.

17 MR. BROOKMAN: Charlie?

18 MR. MCCRUDDEN: Charlie McCrudden, ACCA.
19 What are the numbers in the blue sort of oval cells
20 in the bottom?

21 MR. FRANCO: Yes, the numbers, sorry, I went
22 through this rather quickly because there are a lot

1 of details. The numbers that match the installation
2 location key that is used in the LCC spreadsheet, so
3 number one represents the condition basement, you go
4 to the LCC spreadsheet and try to figure out what
5 is one in terms of the installation location, what
6 that means.

7 MR. MCCRUDDEN: So that's the rank, the
8 most?

9 MR. CYMBAKSY: No, it just keys up to the
10 spreadsheet, so if someone wanted to go and look at
11 the numbers in the spreadsheet, you can go to one and
12 that represents conditions B. It's just a mapping
13 key for the spreadsheet.

14 MR. FRANCO: We will go over the fractions
15 in the next slide. This slide just presents the
16 results that are also provided in the TSD in terms of
17 the installation location. These results are just
18 aggregated by region as well as national. As you can
19 see there's differences in terms of a region which is
20 incorporated into our analysis.

21 So let's go into the installation costs.
22 So we can consider basic installation costs as

1 installation costs that are applicable to all
2 efficiency levels. This includes a trip charge, this
3 includes removal of the existing furnace in the
4 replacement case, putting in place and setting up the
5 furnace, unit start up, checkup and clean up. Gas
6 piping, electric hookup, removal or disposal fees,
7 any additional labor required for attic installations,
8 and the duct work costs.

9 The duct work cost was accidentally
10 removed in the basic installation costs while
11 reformatting the spreadsheets; it is actually not
12 included. This will be added back in the next phase
13 of the analysis since the basic installation costs
14 are the same for all efficiency levels and are also
15 applicable for equipment switching options, electric
16 furnace and the heat pump we will be discussing
17 later.

18 Adding this cost will not impact the
19 difference in the final result between the efficiency
20 levels. This addresses one of the questions from
21 APGA.

22 MR. CYMBALSKY: This would be question one

1 from the installation cost questions in Appendix 8D.

2 MR. BROOKMAN: Do we have comments here?

3 Jim, please?

4 MR. VERSHAW: Jim VerShaw, Ingersoll Rand.

5 So I'm looking at this, how many man hours are

6 included in that typical installation?

7 MR. FRANCO: Thank you for that question.

8 This is Victor Franco. It depends on the input

9 capacity. I believe it is on average either 4 or 5

10 hours, that's the actual kind of unit startup,

11 removing, replacing, and if it is in the replacement

12 situation you have to have the removal of the

13 existing furnace, so that is approximately half of

14 that.

15 MR. VERSHAW: So the 4 or 5 hours, Jim

16 VerShaw again, includes removing the old furnace?

17 MR. FRANCO: No it does not. I would --

18 MR. VERSHAW: 2 more for that, 2 or 3 more

19 for that.

20 MR. FRANCO: For that. Overall it

21 probably takes about 10 hours.

22 MR. VERSHAW: So it's interesting that the

1 north is so much more expensive than north -- national
2 and rest of the country. What's the difference
3 between national and rest of the country, that's
4 another question, and why is the north so much more
5 expensive on replacement than the other parts of the
6 country?

7 MR. FRANCO: Thank you for that question.

8 MR. BROOKMAN: Do you live in the north?

9 MR. VERSHAW: No, I used to.

10 MR. CYMBALSKY: So the national is just
11 the average of the two below it, so the north and the
12 rest of the country -- not north, you weight the
13 average and you get the top number.

14 MR. VERSHAW: So is California north?

15 MR. FRANCO: No that would be rest of
16 country in this picture Frank.

17 MR. VERSHAW: All right, so do you have
18 listed somewhere the labor rates that you assumed?

19 MR. FRANCO: Yes, these are listed in
20 appendix 8D.

21 MR. VERSHAW: If I read that right, it was
22 like \$60.00 an hour for a plumber and an electrician

1 and \$50.00 an hour for a technician, something like
2 that. Was this overhead profit?

3 MR. FRANCO: That is correct, yes, and the
4 rates are different between the -- for example in New
5 York it is expensive, Georgia --

6 MR. VERSHAW: I have been doing a survey
7 around the country for people that work for our
8 equipment. It's higher than that, so we will do
9 something on the comments for that, or we will do it
10 through AHRI.

11 Now to go back to what did you do to
12 validate your number of hours are correct, and you
13 took the dollar per hour from RS Means, right?

14 MR. FRANCO: Yes, that is correct.

15 MR. VERSHAW: What did you do to validate
16 that that was actually real? Did anybody in Navigant
17 or DOE have a furnace installed or get a quote just
18 to see what you would see and then compare that with
19 what this is to see if the real world matches up to
20 this, because it's an awful lot of assumptions.
21 Everything is based on the RS Means dollars for
22 installation.

1 MR. FRANCO: That is correct, thank you so
2 much for that comment. We do try to look at that
3 kind of data. There are data sources that provide
4 from either the homeowner or contractors what they
5 have actually spent and there are national averages,
6 so we try to look at that data and compare that data
7 to our data.

8 Obviously that's a mixture of high
9 efficiency and lower efficiency so we try to weight
10 that and compare it to our values and our values are
11 comparable to those.

12 MR. BROOKMAN: You are next, your name
13 please?

14 MR. MURPHY: Rick Murphy, AGA. I had a
15 similar question and I appreciate that response. We
16 are also in the process of trying to work with our
17 members in their respective communities that they
18 serve to get specific proposals from contractors in
19 the area to have more intelligence, and hopefully, if
20 that is a value to you, we can certainly share that.

21 I do have a question and maybe it is not
22 appropriate here, it may be for the product switching

1 section, but this approach here, is this assuming
2 that every -- in the replacement market, every
3 installation has an opportunity to install a
4 condensing piece of equipment and it is just a matter
5 of cost, or do you also take into consideration
6 households or structures that it is almost impossible
7 to install the equipment?

8 MR. FRANCO: Great. Thank you so much for
9 that question, but we will get into more details
10 regarding the installation of condensing a little bit
11 later. We do assume that you are able to install it
12 even though the costs might be really, really high.

13 MR. BROOKMAN: Mark Krebs, do you have a
14 comment here?

15 MR. KREBS: Well, just to answer the
16 gentleman's question. Laclede people have gotten
17 bids for actual replacements in their actual homes
18 and we are going to -- we did that for the DFR, we
19 commented upon that and we are going to be repeating
20 that for this NOPR.

21 We also have a huge database of appliance
22 efficiency rebates that we have provided to people

1 who have done this and the results of those were also
2 commented upon in the last DFR and to make a long
3 story short, yeah, it seems like DOE kind of low-balled
4 the total installed prices.

5 MR. BROOKMAN: Okay, Mark Nayes online,
6 Mark you are now unmuted.

7 MR. NAYES: Okay. Yep, we are essentially in
8 that northern zone, we are in Minnesota, and for a
9 non-condensing furnace, our total installation cost,
10 not including the furnace, is at least double that
11 number. For a condensing furnace, we are looking at
12 triple that number. We are kind of a middle of the
13 road company. We are not the most expensive guys up
14 here but we are not the cheapest, and that includes
15 permits, materials, electrical, gassing, everything
16 that is involved, the insurance overhead, both of
17 those numbers we see as being low.

18 MR. BROOKMAN: Okay, Mark, that's helpful,
19 thank you. Okay, we are going to proceed.

20 MR. FRANCO: Thank you so much. Let's
21 proceed. So we've already discussed the basic
22 installation costs. Now let's go into a little bit

1 more detail of the venting installation costs. So we
2 do consider some situations where replacing a
3 non-condensing furnace with a non-condensing furnace

4

5

140

6

7 requires some venting modifications.

8

8 These could include chimney lining for the
9 replacement, vent mount modification in case of
10 replacement, and the new metal vent in the new
11 construction, and we will go into more details in the
12 next slide.

13

13 For condensing furnaces, we have to
14 consider installing a new PVC venting. Also, there are
15 cases where you orphan the water heater in terms of
16 the replacement, and we also consider the additional
17 combustion air for direct vent and concealing vent
18 pipe. I'll be discussing that in more detail in
19 subsequent slides.

20

20 Since one of the most important components
21 are the vent length, this slide -- it's a little bit
22 overwhelming -- does provide the methodology for

1 determining the vent length. I will go over it briefly
2 and as carefully as I can, but essentially, we do take
3 into account a lot of different factors in
4 determining the vent length.

5 For example, we take into account the floor
6 height. Typical floor heights are about 8 feet -- 8
7 to 9 feet. RECS provides us with whether there's a
8 high ceiling or a cathedral ceiling, so we take that
9 in account. Also, the number of floors are taken into
10 account, so for example, if we assume that the furnace
11 is in the basement and the house is two stories, then
12 we assume that the venting has to go through two
13 stories if it is vented vertically.

14 In terms of horizontal installations, we
15 also take into account the installation location's
16 square footage so we need to know through what wall
17 and how far the venting has to go to vent
18 horizontally. So we take an average wall length and
19 we have a distribution that accounts for the furnace
20 being not by the wall that it is going to be vented
21 through, but maybe in another location, so potentially
22 the furnace is in a wall and maybe it is by the wall

1 but it can be vented through that wall.

2 Maybe the situation might be that there is
3 a -- it's sharing a wall with the neighbor or that
4 wall is the wall that's the exterior wall. So we
5 assume that on average the furnace is more or less in
6 the middle of the building and then we assume a vent
7 length. There is a distribution applied to that so
8 there are some cases where the furnace does vent
9 through that wall and there is to the furnace and it
10 is the short length.

11 There are other situations where it has to
12 vent through the full building and those would
13 require the greatest vent length. In terms of
14 horizontal venting, there's an additional component
15 which is the horizontal in terms of horizontal
16 there's an -- horizontal and vertical, there are
17 additional for horizontal and vertical distances that
18 need to be taken into account and these are the last
19 few boxes. So for example, if you are venting
20 vertically, you need to account for some horizontal
21 distance. We assume about three to six feet.

22 In terms of the horizontal venting, we also

1 account, for example, if it is in the basement, you have
2 to go at least three feet above ground and to vent
3 horizontally, and that would be the vertical distance,
4 well at least part of the vertical distance.

5 So let's go into a little bit more detail
6 about what we mean by non-condensing in the
7 replacement cases venting installation costs. So
8 first there are some masonry chimneys that require
9 re-lining. There are a number of households,
10 especially in the north, that have a chimney. The
11 furnaces that were installed before 1995 were built
12 before 1995 are assumed to not be applicable to the
13 latest national gas code and might require relining
14 of the masonry chimney.

15 DOE does also consider vent resizing and
16 vent connectors that are required. This is the case
17 mostly of installations where you have a furnace that
18 is a natural draft furnace that is installed in the
19 household and so we assume that if the household has
20 a natural draft and non-weatherized gas furnace that
21 might fall into that category.

22 We also consider whether the unit is going

1 to be replaced before the standard in 2021. Once it
2 is replaced, obviously it will be a natural draft
3 furnace and if the chimney has been relined.

4 Here are the fractions of the existing
5 masonry chimney and venting installations that come
6 from GTI survey done in the 1990's. They are
7 disaggregated by different regions. As you can see
8 there's a significant regional variation.

9 MR. BROOKMAN: Marshall Hunt?

10 MR. HUNT: Yes, one of the things -- Marshall
11 Hunt, Pacific Gas and Electric Company. One of the
12 things we were looking at in California is there is a
13 lot of tran-site asbestos-based sedimentacious flues
14 out there so how -- where would you place them in
15 this analysis?

16 MR. FRANCO: I'm sorry I didn't catch the
17 first part of your question?

18 MR. HUNT: A lot of flues in the older
19 homes are asbestos-based transite, that hard pipe,
20 where would you include that in this analysis?

21 MR. FRANCO: Well, it is currently not part
22 of the analysis. Please submit any data that you might

1 have about that and we will definitely look into
2 that, thank you so much for that comment.

3 One thing that's important to know, and
4 it's a part of this analysis but it is not here, is we
5 also take into account the fraction of commonly
6 vented water heater and furnace situations by region.
7 It's a similar table to the one shown here, it's in
8 the TSD, it's table 8D.2.8 and it is also based on the
9 GTI study done in the '90s, and the results from that
10 are about half of commonly vented installations --
11 those commonly vented installations becomes more
12 important in condensing cost analysis.

13 MR. MCCRUDDEN: This is Charlie with ACCA.
14 Marshall I wanted to ask a follow-up. You mentioned
15 the word asbestos pipe or something, I just heard
16 asbestos. What are the implications of your question
17 essentially on an installation?

18 MR. HUNT: Our friends at So-Cal Gas are
19 concerned about the added cost for installation.

20 MR. MCCRUDDEN: So is there a remediation
21 that is required, what's --

22 MR. HUNT: It's potential, so we will get

1 more data.

2 MR. MCCRUDDEN: Okay thanks.

3 MR. BROOKMAN: Yes Andrew deLaski?

4 MR. DELASKI: Victor, you mentioned
5 relining. Is there relining in the base case in some
6 instances?

7 MR. FRANCO: This is Victor Franco. That is
8 the case, that is what we are trying to describe in
9 this slide. So we are going from a non-condensing,
10 maybe like a natural draft but it could be also a
11 non-condensing current furnace to a baseline and
12 non-condensing furnace, 80% furnace, so that is the
13 baseline.

14 MR. DELASKI: Okay, got it. Thank you.

15 MR. BROOKMAN: Okay, Mark?

16 MR. KREBS: Victor, Mark Krebs with
17 Laclede Group again. I don't want to mess up your
18 delivery here, but when would be a good time to talk
19 about the ductwork issues that we discussed yesterday,
20 you know, and the fact that typical duct work really
21 means bad duct works because, commonly, more often than
22 not, they are bad duct work -- they cause a lot of static

1 pressure that has a lot of implications for
2 electricity consumption.

3 When could we get into that or can we?

4 MR. FRANCO: Yes, we do get into that in
5 the electricity use. DOE does not assume in its
6 analysis that there is any installation costs related
7 to improving the duct work, it just assumes that there
8 is an increased use if you have the situation of bad
9 ducts in its analysis, similar to what we did for
10 furnace fans and what we have done in the past.

11 MR. KREBS: I tried to get a feeling, maybe
12 if you would help me, if you guys could break out, you
13 know, what portion of that electricity comes from the
14 added static pressure of the condensing furnace
15 compared to the remainder that comes from the duct
16 work system, you know.

17 If there is a way to break that out, I
18 think we could have a better opportunity to dig into
19 it and come back with some meaningful comments.

20 MR. FRANCO: Thank you so much, we can go
21 into that in electricity use in a little bit more
22 detail.

1 MR. KREBS: Okay I'll hold you to it.

2 MR. FRANCO: Thank you so much and remind
3 me if I don't.

4 MR. BROOKMAN: Jim VerShaw?

5 MR. VERSHAW: Jim VerShaw. A quick
6 question on the existing non-weatherized gas furnaces
7 less than 75%, are you saying that in your analysis
8 that 3/10ths of the installs would be that way?
9 3/10ths of a percent, I don't understand the fraction
10 impacted column.

11 There's another column in the TSD that was
12 probable and that had been impacted and they were two
13 different numbers, I wasn't quite sure how you used
14 that. Because, if you think about it, come 2021, that
15 will be 29 years after we pretty much got rid of
16 atmospheric furnaces, and I think furnaces are known
17 to last 21 years, so they probably should be
18 looked -- I would think that there would be almost
19 none out there at that point. Is that what that
20 says?

21 MR. FRANCO: That is exactly true and
22 that's why we take into account if there have been

1 installations, so just to clarify a little bit in more
2 detail. RECS does provide the age of the furnace,
3 so we know if the furnace, for example, has been
4 installed after 1990 or 1995, and then we can assume
5 whether those would be natural draft. But then we
6 would have to assume what happens between 2009 when
7 the survey was conducted to 2021 so obviously in 2009
8 there's a larger fraction.

9 By 2021 there's a much smaller fraction.
10 This is what that represents, on natural draft
11 furnaces.

12 MR. BROOKMAN: Chuck?

13 MR. WHITE: Chuck White with PHCC. So I
14 don't know if it is going to be wrapped in here
15 somewhere but first I would like to comment, the
16 common water heater and furnace I think your 50%
17 probably low, but PVC venting, do you have
18 consideration for maximum point for piping
19 equivalent, like fittings, in consideration of
20 termination of where those can be: not over public
21 right-of-ways, not related to open windows, forced
22 air ventilation, going through multi-family,

1 multi-story buildings, traversing other property
2 lines, exceeding maximum vent heights, going through
3 multi-story buildings, I can go on.

4 MR. FRANCO: Thank you so much for that
5 comment. The next slide actually provides that and I
6 will be going into that in more detail, and obviously
7 if that is what you are more interested. Let me just
8 point out before going to answer your question, the
9 last thing on this slide, it does provide the average
10 cost for all of these different situations and is
11 noted the different fraction of impacted units.

12 So let's go more into a big piece of the
13 installation costs for condensing furnaces. So there
14 is a situation where you would go from a
15 non-condensing furnace, either potentially natural
16 draft, but most likely currently available 80%
17
18 furnace to condensing furnace, and so we take a
19 lot of the factors that you have described into
20 account as much as we can for each individual
21 household.

22 So as described before we take into

1 account the furnace where it is actually an
2 installation location. So as I tried to describe it
3 before in that complicated flow chart we are trying
4 to assess what would happen in each individual home
5 which is pretty complicated.

6 There is a situation that a fraction of
7 the households where you could potentially have a
8 furnace as I mentioned in the wall, the easiest would
9 be to have the venting through that wall horizontally
10 but for whatever reason you can't have that. So
11 there is a situation where you might have to actually
12 go through all the way as far as possible to say for
13 example if you are in this corner diagonally all the
14 way to the other diagonal.

15 And in addition to that you might go
16 through multiple walls because that might be a wall
17 that's a room that you have to drill a hole through
18 that and then go through another one and then you
19 have to account for the verticals, you might have to
20 drill holes through vertical floors potentially and
21 then go horizontally. So it does take that into
22 account in terms of installation and these are all

1 fractions obviously.

2 There are fractions of installations where
3 you can just drill through that wall. Maybe it's a
4 closet and that's a perfectly good wall so that's why
5 we do that because we understand that there are many
6 situations where because you are going up for example
7 from the basement that wall potentially has a lot of
8 windows, and you can't go and drill a hole through a
9 window or close to a window, you don't want to have
10 those flue gasses going through there.

11 MR. BROOKMAN: Yes, Neil?

12 MR. LESLIE: Neil Leslie, GTI. Just to
13 make sure that we understand the specific numbers
14 that are used you said there were some average costs.
15 Now when you get to an individual house in the 10,000
16 runs you have incremental costs attached to that
17 individual house configuration, is that right?

18 MR. FRANCO: No, the cost to each
19 individual house or the cost of that specific house
20 installation so for example, lets go back to that very
21 complicated installation household. So it's in the
22 wall, kind of in the diagonal and you have to go

1 through multiple walls that cost is applied to the
2 household installation cost.

3 For another household potentially it just
4 goes through to that wall and so it's a very small
5 cost to do the venting so it is individual, household
6 by household.

7 So, I kind of described already some of
8 these points, but just to reiterate, we do go and
9 account for ceiling height, number of floors, the
10 distance from the wall or roof, whether it can be
11 vertical or horizontally installed, so there are some
12 situations where you can actually have vertical
13 installation and it might make the most sense for a
14 condensing furnace.

15 And finally we take into account the vent
16 termination. There are a couple of points here for
17 this that describe some comments that we have
18 received, so I will go through those in a little bit
19 more detail related to these two last points.

20 In terms of wall penetration, there is no
21 electrical work required in this PVC venting
22 installation work. DOE estimated the cost of drilling

1 a hole into a wall to install PVC venting based on
2 similar work required for drilling holes and for
3 electrical work for our estimates, and this is common
4 practice. Sometimes there are costs and ours means in
5 one area or another, and it is assumed that the costs
6 are similar to, for example, doing that electrical
7 work.

8 In the 2011 TSD, there was a \$35.00 value
9 that was added to the material costs associated with
10 drilling a hole. This cost was incorrectly reported
11 in the TSD itself. It did not exist in the
12 spreadsheet analysis or in the analysis in 2011 or in
13 this analysis in 2014, so that is related to a
14 specific question we received.

15 In terms of vent terminations this is
16 addressing we were asked a specific question -- and this is
17 related to the vent termination. How we deal with
18 it. DOE assumed that, for all horizontal vent
19 terminations for condensing furnaces, require adding a
20 three feet of PVC above ground level and a 90 degree
21 level elbow as a proxy toward the termination count,
22 assuming that this was equivalent to an average

1 requirement for installation -- what is commonly called
2 a snorkel type vent termination -- so you can imagine
3 you going up vertically about three feet then
4 horizontal and then you have a termination so it
5 makes kind of like a snorkel, so that's what is meant
6 by the snorkel termination.

7 The venting termination takes into account
8 the closest wall that might be appropriate to install,
9 as we described earlier, so it takes into account the
10 issues of the windows, doors, decks, overhangs,
11 sharing of walls with other as we have described
12 earlier.

13 MR. CYBALSKY: So, this is John from DOE,
14 so, the last two points were questions two and three
15 from the APGA submittal under the installation costs
16 section.

17 MR. FRANCO: So I will very briefly go
18 through these next few points because we will have
19 subsequent slides. We do take into account
20 combustion and air vent for direct vent installations
21 and we will go through the fractions in the next
22 slide.

1 We do go through concealing vent pipes for
2 indoor installations, so this is the case where you
3 might have your furnace installed in a closet, you
4 have to go through some other part of the living area,
5 and that might not be something that you want to do,
6 so, you want to conceal that somehow so that it's
7 architecturally not something that's not that
8 beautiful, or good.

9 The next thing is, we take into account
10 orphaned water heaters. So there are some
11 installations that require relining of the chimney or
12 resizing for the condensing weatherized that replaces
13 an existing non-condensing, non-weatherized furnace.
14 In that case the orphaned -- what is called an orphaned
15 water heater, might not have the appropriate venting
16 to vent by itself, and so, in that case we do consider
17 additional vented costs just for the water heater.

18 MR. BROOKMAN: Mark Naves has a question
19 from online. He asked: have you taken into account
20 gravity vent furnaces that are still found in old
21 homes?

22 MR. FRANCO: Yes, thank you so much for

1 that question. Yes, we do. Sometimes the terminology
2 for that is natural draft but that is what we mean by
3 natural draft gravity forced furnaces, thank you.

4 MR. BROOKMAN: Harvey Sachs?

5 MR. SACHS: Age before beauty.

6 MR. BROOKMAN: Impetuousness before looks.

7 MR. WHITE: I'm neither. This is Chuck
8 White. I'm not sure, I think what your online caller
9 might be referring to is gravity furnaces not gravity
10 vent, not gravity draft where you don't have an
11 indoor blower, you have large duct work and there is
12 going to be significantly larger change out costs and
13 I'm putting words in his mouth but I think that might
14 be what he is talking about -- not natural draft.

15 MR. BROOKMAN: Okay thank you. Harvey go
16 ahead.

17 MR. SACHS: I have followed industry work
18 recently on the orphaned water heater issue. As I have
19 done that I have tried to find unsuccessfully some
20 simulations done in the report issued by GRI sometime
21 I believe before 1990 and if I am remembering this
22 correctly and I think it needs to be updated, there

1 were two things associated with it.

2 One of them was that in the South was
3 impossible or extremely unlikely to cool even an
4 outlying chimney and they would likely have back
5 drafting from gas water heater on very cold days in
6 the orphaned situation and even as you move North it
7 was much more likely to be a problem depending on the
8 position of the chimney.

9 If it was an external chimney, masonry
10 chimney that is one three sides exposed, you have a
11 lot more cooling effect than if it was a central chimney
12 that descended through the center of the house and
13 had the last few feet through an unconditioned attic.
14 And I don't want to delay this but I think that we
15 need to have this kind of granularity to handle the
16 problem of orphaned water heaters.

17 My own instinct is that it is a less
18 frequent safety hazard than has been estimated in
19 worst case efforts. Others may feel that we need to
20 err on the side of safety, but I think that, in the
21 absence of good field data, an updated simulation
22 that breaks out locations in heating days is

1 important.

2 MR. BROOKMAN: Jim?

3 MR. VERSHAW: Well, there's been a lot of
4 work done on venting of natural draft appliances and
5 a lot of work was done and created the venting guide
6 that's in the national fuel gas code and we all apply
7 it to our products. I think that you could look at
8 the type of product and look at the heating and
9 firing rate is and tell you what size vents you need.

10 And what happens is when you go from
11 50,000 plus 100,000 to 50,000 it's so big they can't
12 draft so it has got to get smaller. And then if you
13 have single wall many times you have to go to double
14 wall on the connector.

15 MR. SACHS: I understand that, I have done
16 the relining for orphan water heater according to
17 code myself not often.

18 MR. VERSHAW: I've never done it, so...

19 MR. SACHS: I have more field experience
20 then but I am just saying that this is an area, and
21 you are absolutely right that quite often you will
22 need at least a single wall vent but I think that we

1 need to understand the orphaned water heater problem a
2 little better than I have and also look, and I hate to
3 bring up -- no I enjoy bringing up the learning curve
4 where again we have seen a fair amount of work based
5 on international experience leading to the hypothesis
6 that common venting solutions are quite likely to be
7 available and I think we need to understand those
8 better as well.

9 MR. BROOKMAN: Thank you, we are going to
10 press on.

11 MR. VERSHAW: While you were talking I
12 read ahead and I think I answered it so I think I'll
13 wait on it.

14 MR. FRANCO: Thank you so much. We will
15 go through here are the more details about the direct
16 vent, PVC venting. Here on this slide the motion
17 points are the fractions that we are assuming for
18 direct vent depending on the installation location so,
19 as you can see, they vary from 100% in the garage to
20 33% in unconditioned basement and crawl spaces.

21 This comes from a consultant report that's
22 available in Appendix 8B of the 2011 DFR. This whole

1 report is fully available in that appendix. This
2 answers again a question.

3 MR. CYMBALSKY: This is John from DOE. So
4 there was in the section entitled questions not
5 previously answered by DOE question 8 so that we
6 point you to where you can get that consultant's
7 report. We will also put it in the new docket, the
8 current rulemaking docket.

9 MR. FRANCO: Just the next few rows give
10 you a sense of the fraction of installations by
11 region or nationally of these different installation
12 locations, so don't mix these two numbers up but if
13 some products, for example, the fraction of direct
14 venting installations by the North fractions of
15 installations you would get the resulting 58.7%, that
16 is direct vent.

17 So that's in the North on average we have
18 applied 58.7% of the installations we have applied
19 direct vent. Again this cost is individual to the
20 household and so if the household does have direct
21 venting, the cost is applied, if it doesn't, it won't be
22 applied. This number -- results for the rest of the

1 country and the national so about 60% of households
2 are about roughly 59% of households have direct vent.

3 This is --

4 MS. ARMSTRONG: This is Ashley from DOE
5 and we have a question from online from John Gibbons.
6 He wanted to know did you take into account freeze
7 protection of condensate removal and how much did you
8 include in the cost impact? Were you mindful of many
9 municipal codes that do not allow condensate draining
10 into simple sewer lines?

11 MR. FRANCO: Thank you so much for that
12 question. We will be addressing that in a couple
13 more slides so I will just address that when we get
14 there.

15 MR. BROOKMAN: Frank Stanonik?

16 MR. STANONIK: Frank Stanonik, AHRI. I
17 guess I am just going to ask confirmation. So if the
18 unit -- if it is in a basement, the assumption is that
19 67% of those will be direct vent installation for a
20 condensing product, right?

21 MR. FRANCO: That's correct.

22 MR. STANONIK: And you are assuming that

1 same percentage if it is installed essentially indoors -
2 which might be a closet, alcove or utility room -- which
3 I would venture in many cases is going to be I would
4 say centrally located in the residence as opposed to
5 anywhere near an outside wall or whatever.

6 I guess I'm trying -- how did you come to
7 the conclusion that it is likely that a condensing
8 furnace installed in an indoor location like a closet,
9 alcove, and so on is as likely to now be direct vent
10 as one that is in a basement? To me, how did you get
11 to the conclusion it has the same likelihood, I guess?

12 MR. FRANCO: Yes, thank you for that
13 question. Note that the basement has a conditioned
14 space which is the 67% that they are referring to so
15 this would be similar to an indoor location because
16 you assume that it is conditioned so maybe it's like
17 a game room or some other -- had some other use
18 versus a basement that is in an unconditioned space
19 which has a different fraction 33%.

20 So the assumptions from the consultant was
21 if this is in the space that is kind of the
22 conditioned indoor space, the fraction would be a lot

1 higher so it would be 67% in those cases for example
2 the condition a basement, or indoor or attic which
3 are also in the conditioned attic.

4 When it is in the unconditioned space, such
5 as in a basement which is unconditioned, or crawl
6 space of an attic which is unconditioned, the same
7 fractions are 33% so we assume that is lower.

8 And then the garage-- we assume that's 100%
9 because of potentially the gas.

10 MR. STANONIK: Frank Stanonik. But so the
11 conditioned basement right, but again if well -- I
12 think about conditioned basement and I still think of
13 a fairly open space. At least most basements actually
14 when you get down in the basement it is not for the
15 compartmentalized, even conditioned ones into small
16 rooms and stuff, and yet again the indoor installation
17 of use as you have described it there, those are
18 essentially, to a large degree, a confined space and so
19 to me with that very simplistic view the likelihood
20 of getting a direct vent installation into a confined
21 space installation of sorts -- compared to this
22 conditioned basement which I consider a wide open

1 space, I am still having a hard time saying that
2 those would be the same.

3 MR. FRANCO: Thank you for that no, we
4 really appreciate your comments. Please provide
5 detailed description of what you would think we could
6 refine in terms of those fractions because that would
7 be really helpful. Obviously, there aren't any
8 surveys available for what these fractions should be
9 and these are assumptions currently based on this
10 consultant report so any feedback would be really,
11 really appreciated, thank you so much.

12 So, I will go kind of quickly through this
13 one. This relates to the concealing of the vent
14 pipes so we do take that into consideration. That
15 impacts a fraction of the installations that are
16 located in indoor locations. We assume that 50% of
17 indoor locations would have this impact so the
18 fraction impacted overall is 9%. The average cost is
19 \$360.00 obviously this is a distribution of costs
20 depending on the vent length so if you have a short
21 length that you have to conceal the costs would be
22 much lower.

1 If you have a much larger space then the
2 length they have to conceal, its cost would be much
3 larger.

4 This next slide summarizes the venting
5 that's required both in the non-condensing and the
6 non-condensing to condensing and to note that in the
7 non-condensing to condensing this mainly just deals
8 with the orphaned water heater. So let's go take a
9 look first at the non-condensing to condensing.

10 These are the fractions of installations
11 which is fairly low that are impacted by having to
12 redo or resize the venting going from non-condensing
13 to non-condensing. So the fraction impacted is about
14 total fraction is about 2.2% and is based on the
15 assumptions we have described earlier.

16 In terms of the fraction of the impact by
17 orphaned water heaters the fractions and the
18 differences are described here and the overall impact
19 is close to 20%. Most of the impact is having to
20 resize the orphan water heater or the last row and
21 this is just an assumption that we are making that
22 40% of the time that has to be done and that impacts

1 18% of installation.

2 The costs are also provided. Again, these
3 are average costs for the individual households. These
4 costs can be very, very different. In the case just
5 of the orphaned water heater, because this is vertically
6 vented, these costs could be fairly large. If you
7 are going through multiple floors, you have to do

8

9

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10

11 potentially the relining of those. We also take into
12 account the installation costs to new construction
13 and new owners. New owners would be people that are
14 potentially installing this equipment for the first
15 time in their home, doing maybe a major remodel or
16 people that are switching to another equipment that
17 didn't have a gas furnace previously.

18

19 These installation costs for
20 non-condensing include adding the whole vent system,
21 and if it is commonly vented then adding the vent --
22 the commonly venting from the orphan water heater
from the commonly vented water heater.

1 For the condensing non-weatherized gas
2 furnace we do account also for the PVC venting -- as we
3 have described earlier -- and we account for the plan
4 installation of the non-condensing commonly vented
5 gas water heater that now needs to be orphaned. So
6 we take into account that difference in cost.

7 MR. BROOKMAN: We have a question from an
8 individual on the line. I believe his name is Michael
9 Strom. Michael asks, how does collect seal venting
10 system fit in the analysis both in a configuration as
11 relining on a b-vent with a liner and using the
12 b-vent as air duct and a new pre-fab co-axial system?

13 MR. FRANCO: So thank you for that
14 comment. I believe that is something that we will be
15 addressing later in the later slides so when we come
16 to that point watch.

17 MR. BROOKMAN: Okay, I'll pull this out and
18 re-raise it later, keep going.

19 MR. FRANCO: Thank you so much so let's go
20 to the next slide. So now we are moving on to the
21 last component of the installation cost. This only
22 impacts condensing furnaces and this relates to

1 questions raised before about the condensate
2 withdrawal.

3 This flow chart represents our overall
4 methodology again this is done for each household
5 depending on different situations that occur. First
6 we take into account where the household is located
7 if it is location in a for example -- it's located in
8 an attic we do take into account freeze protection in
9 the case of a non-weatherized gas furnace.

10 If it has a central air conditioner we
11 take that into account in terms of whether we
12 consider if it has a condensate pump or not. The
13 central air conditioner might already have a
14 condensate pump in that location and an additional
15 one might not be required.

16 In the case of a condensate pump or heat
17 tape which is the case when we are dealing with
18 condensate freezing we do also apply the cost of the
19 electrical outlet. All of these different costs,
20 including the condensate piping and the drip pan, are
21 what are part of the condensate removal costs.

22 To address one of the specific questions

1 that we had earlier, we do take into account the
2 condensate neutralizer in terms of neutralizing the
3 condensate acidity and this is applied a fraction at
4 a time. Costs are also added and this deals with
5 locations where this is a requirement by code.

6 MR. BROOKMAN: Frank Stanonik?

7 MR. STANONIK: Frank Stanonik, AHRI. All
8 right, so if I am understanding your little flow chart
9 there, the only time you are considering the cost of
10 the condensate pump is if the house doesn't have air
11 conditioning, central air conditioning?

12 MR. FRANCO: That is correct, that was --

13 MR. STANONIK: And so that's a fundamental
14 error. That's an error, okay. I'll tell you right
15 now in this area where we live, where I live, where
16 everybody living in this area okay -- my air
17 conditioner the condensate is just drained outdoors
18 because it can be, it's not going to freeze up in the
19 summer.

20 But my condensing furnace because it
21 cannot take that condensate outdoors because it will
22 freeze had to have a condensate pump so it could pump

1 it to a place where I could drain it. So the issue
2 is not simply whether or not the house has a central
3 AC, but it is an issue of whether a household is
4 located in a climate zone where the condensate will
5 freeze and so it cannot use the same line as the
6 central AC might as you might incur in the South.

7 So I think you are underestimating on the
8 installation costs.

9 MR. BROOKMAN: Harvey Sachs?

10 MR. SACHS: This is Harvey Sachs and I
11 happen to live in North Virginia as I believe you do
12 and I do have a condensate pump which carries the
13 condensate from both the air conditioner where the
14 condensate drain is next to the furnace cabinet and
15 from the condensing furnace. I believe that that
16 will be typical for all houses for almost all houses
17 which have the equipment in the basement because you
18 have to pump it anyhow and in that case I don't know
19 if it is code approved or not but that small amount
20 of condensate is joined with the air conditioner
21 condensate and it moves to the common sewer. I had
22 to do the pump for the air conditioner so I am using

1 this end pump for the furnace.

2 I suspect that that is far more common in
3 basement-equipped houses than we are assuming from
4 your remarks.

5 MR. BROOKMAN: Frank?

6 MR. STANONIK: Frank Stanonik. For a
7 point of clarification, a point well taken. In fact
8 my house you walk out and it's multi-level so I can
9 walk out of my basement out the back so, in fact, I do
10 have a free wall where my air conditioner does simply
11 drain, the condensate does just go outside.

12 But if it was totally a basement
13 surrounded by earth on all walls you are correct.

14 MR. BROOKMAN: We have questions and
15 comments from, I believe, Jerome Ryan, and he says
16 because of the complexities of installing high
17 efficiency furnaces, has DOE contemplated the costs of
18 contractor education needs associated with this
19 ruling and how many contractors may need this
20 training and continues -- were these overhead costs
21 inputted into the model and can you comment about the
22 efficiency gains lost with its poor installations?

1 MR. MCGRUDDEN: This is Charlie with ACCA
2 and I am being looked at by Ashley and John but I
3 think the question was to you so I would like to hear
4 what you have to say first.

5 MS. ARMSTRONG: Perhaps you can address
6 the first part of the question which is more of a, you
7 know, what kind of training do you have today with
8 condensing furnaces and you know is there a need for
9 further training because I'm guessing that you are
10 currently giving training to your different
11 contractors or at least providing them that
12 opportunity so I guess what would be the differential
13 or would there be one?

14 MR. MCGRUDDEN: So this is Charlie, I
15 think a lot of the manufacturers through their dealer
16 networks, through the wholesalers provide a lot of
17 training especially on new equipment and new
18 technologies. We certainly do a lot of training for
19 quality installation and that looks at more than just
20 -- that looks at how to install the box properly duct
21 ceiling, sizing and on the case of CAC and heat
22 pumps, refrigerant charge and things like that.

1 So you know, again, that's what I was sort
2 of looking to see what DOE had contemplated in terms
3 of what might be the costs or how would training play
4 into the analysis here because you may have a whole
5 subset of contractors who have never touched a
6 condensing furnace because they never had to.

7 MR. BROOKMAN: Okay, I think we should keep
8 moving on. For those of you that are interested, and
9 probably all of you are, shortly we are going to pause
10 for lunch in say ten minutes or so.

11 MR. FRANCO: Okay thank you yes, we are
12 almost finished with the installation costs so a few
13 more slides.

14 MS. ARMSTRONG: Just Charlie to your point,
15 I mean, I think that we didn't account for any
16 training that would be necessary, so I think what we
17 would be looking for from you and/or the other
18 contractors on the phone in and around the table
19 today would be you know what if any that delta would
20 be in terms of what is being done today versus what
21 might need to be done in the future.

22 MR. MCCRUDDEN: And this is Charlie with

1 ACCA again and we will certainly put something to
2 that effect in our comments.

3 MS. ARMSTRONG: Thank you.

4 MR. BROOKMAN: Thanks Charlie, Harvey
5 Sachs?

6 MR. SACHS: This is Harvey and gee I'm
7 looking around the room for John, he's assured me
8 that a great deal of training on all sorts of
9 products is being done by his members.

10 MR. BROOKMAN: Okay again proceed here.

11 MR. FRANCO: Thank you so much for all of
12 those comments. We are going to now summarize. This
13 simply summarizes the condensate removal in terms of
14 the fraction impacted and the average cost of supply.
15 Obviously there is a distribution. This is available
16 in the TSD if you have any further comments please
17 let me know right now.

18 MR. BROOKMAN: Steve Rosenstock?

19 MR. ROSENSTOCK: Steve Rosenstock, Edison
20 Electric Institute. For the condensate pump you are
21 saying 25 and this is in the replacement, 25% of
22 installations without AC is that central AC is that

1 what you are referring to?

2 MR. FRANCO: Yes, I can give that
3 clarification that's central air conditioners.

4 MR. ROSENSTOCK: And again thank you for
5 that Steve Rosenstock, EEI and then are you assuming
6 that number stays static over the next 20 - 30 years
7 because most new homes are built with central AC so
8 wouldn't that percentage go down over time?

9 MR. FRANCO: We do segment our household
10 sample between replacements and new construction. In
11 terms of new construction, that fraction is already
12 lower. In terms of the current stock, it would be
13 higher so that is already taken into account, thank
14 you for that comment.

15 MR. ROSENSTOCK: Thank you.

16 MR. MCGRUDDEN: Charlie with ACCA. On the
17 -- some of these I guess - adders, you call them -- have an
18 electric use implied themselves, is that factored
19 into the analysis?

20 MR. FRANCO: Thank you so much for that
21 comment. I was actually going to bring that up, I
22 forgot to bring that up earlier. For example heat

1 tape and the condensate pump do have in fact
2 electrical components that we will be discussing
3 later. They also have components in terms of
4 actually doing repair and maintenance to them and
5 those are accounted in the repair and maintenance as
6 well, thank you for that comment. Let's move on to
7 the next one.

8 MR. BROOKMAN: Let's wait right there, we
9 are moving on to a subject matter there so we should
10 pause and we have a comment from or a question from
11 Mark Nayes who asks, condensate pumps are far less
12 common in Minnesota. Mostly the AC and furnace
13 condensate drain to a floor drain, is there a worst
14 case scenario for installation costs?

15 MR. FRANCO: Thank you for that comment.

16 MR. BROOKMAN: And Rick?

17 MR. MURPHY: Victor thank you for this and
18 I understand there is another phase of the life-cycle
19 costs we haven't gone into but just thinking about
20 what we have covered thus far, equipment costs,
21 installation costs, and how this comes into play and
22 the life-cycle cost analysis. I am looking at the

1 life-cycle cost spreadsheet that was provided by DOE.

2 And the sensitivity that I think I'm
3 drawing from this on how important this information
4 is and good data, and it appears that installation
5 costs are a sizeable component of the overall
6 installed costs so when I look at the life-cycle cost
7 savings of a 92% versus an 80% of \$39.00 over the
8 life of that piece of equipment increases in the
9 installed costs and equipment costs by \$39.00 could
10 have a direct impact or additional savings or reduced
11 costs in equipment or installation costs could
12 actually increase that.

13 I just want to make sure I'm following the
14 logic here because to me that's a message to our
15 industry to ensure that we get these installation --
16 these data on installation costs particularly right
17 because it can have a really important change in the
18 way the life-cycle costs actually comes out.

19 MR. CYMBALSKY: This is John from DOE.
20 Yeah, we agree. We think all the data that is part
21 of this is important to get your feedback on so that
22 is why we are here today. If you have comments on

1 the data, what the values should be please submit the
2 data and we will consider.

3 MR. MURPHY: Thank you John, Rich, Murphy
4 again. I guess my point John, was with installation
5 costs and equipment costs, those are zero dollars
6 right so it is a wonderful impact to the life-cycle
7 cost savings in the present value analysis is that
8 correct?

9 MR. CYMBALSKY: Right so they are upfront
10 costs that's right and those time you get the savings
11 back at a discounted format, that's correct.

12 MR. BROOKMAN: Final comments on the
13 foregoing slides? Mark?

14 MR. KREBS: I was just wondering at what
15 point would it be good to discuss the discount rates?

16 MR. BROOKMAN: That's going to come later.

17 MR. CYMBALSKY: If we click to the next
18 slide you are going to see why we are going to take a
19 break, so we are going to all eat and we are going to
20 get ready for this one when we come back.

21 MR. BROOKMAN: I am going to propose, we
22 usually take an hour for lunch but we -- I'm worried

1 we are not going to get through all of this, I am
2 going to propose we do this in 45 minutes. It's now
3 1:00 which means we resume at 1:45. For those of you
4 who are not familiar with the Forrestal Building
5 please make sure you have a badge, this room will be
6 secured. There are restrooms on both ends of the
7 hall, there's a big cafeteria down to the ground
8 floor.

9 (Whereupon the meeting recessed for lunch to
10 reconvene at 1:45 p.m.)

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1 A F T E R N O O N S E S S I O N

2 MR. BROOKMAN: So we are now by my
3 reckoning on slide number 51 and we are going to
4 proceed with Victor Franco life-cycle costs and
5 payback period analysis, installation costs by market
6 segments.

7 MR. FRANCO: Thank you so much, this is
8 Victor Franco again. Welcome back -- thank you. So
9 I'll start this slide -- this slide is an eye sore
10 obviously it is a little bit better in printed form
11 hopefully you can read a little bit. It is not meant
12 to go over all the details it is just meant to kind
13 of be an overview of what we have discussed in terms
14 of the installation costs for non-weatherized gas
15 furnaces.

16 The main purpose here is to --

17 MR. HUNT: Is that in the technical
18 support document somewhere?

19 MR. FRANCO: This is correct I was going
20 to point that out. This chart is in appendix 8D.

21 MR. HUNT: Thank you, Marshall Hunt.

22 MR. FRANCO: And there is a further

1 description about what this all means and everything.
2 I just wanted to point out a couple of things in this
3 to kind of summarize installation costs. One main
4 thing is that we disaggregate the cost between the
5 different markets as I have described earlier, the
6 building sample kind of has some of the
7 disaggregation.

8 So if we start from the REC sample which
9 is the yellow box then we consider whether the house
10 is going to be installing a condensing furnace. In
11 terms of whether the condensing furnace is already in
12 the house or not that's taken into account in these
13 boxes and there are fractions that you can actually
14 read and see what are the fractions that are the
15 segmentation of these -- again this is very detailed
16 and a lot of details is in Appendix 8D.

17 So the main point is that we do have a new
18 construction installation cost that is included, we
19 have the new owners, fractions and we have
20 replacements so it is all included in the analysis
21 and the fractions are provided here.

22 MR. CYMBALSKY: So this is John from DOE.

1 We are going to move on because in the interest of
2 time but this is kind of take home homework for
3 everybody where you can read it better and look at
4 it. We tried to do I think of every type of
5 installation possible and we have it on this flow
6 chart so this is for your comment in the open comment
7 period.

8 MR. BROOKMAN: Mark?

9 MR. KREBS: John Mark Krebs, did our end
10 time get extended to 5?

11 MR. CYMBALSKY: 5 o'clock, we have always
12 had 5 o'clock. It's hard to stop at 5 though just so
13 you know.

14 MR. FRANCO: Thank you. So I'll move on.
15 This is the mobile home gas furnace this explains the
16 cost that we used. We did take into account venting
17 and condensate removal where the condensing -- where
18 the descriptions are in appendix 8D and show how we
19 applied this for a mobile home, because this is
20 further answers any questions?

21 So now we are moving on to a new topic,
22 this is the energy use characterization. Some of

1 these slides are moving a little bit quicker than
2 others. This is just kind of the purpose and method
3 so we are trying to determine the annual energy
4 consumption of non-weatherized gas furnaces and
5 mobile homes for the LCC analysis and payback period.
6 This is the equation to focus on because we are going
7 to be discussing these two parameters.

8 So first the pool energy use is segregated
9 between the fuel use and the electricity use so we
10 will be discussing these separately in the next
11 couple of slides. Before going into more detail
12 about the fuel use and we have already discussed this
13 a little bit, one of the most important components
14 for the energy use is the building sample.

15 RECS and c-becks which is also used in
16 this analysis does provide the energy use of the
17 building or the household and the -- we use that in
18 our analysis. They actually provide the heating
19 energy use. So to determine whether a household in
20 this survey falls under our analysis we use this
21 process.

22 First we determine if the furnace is used

1 for space heating or the household uses a furnace for
2 space heating. If it doesn't, it's out of the sample
3 and we also see if the household is in a building or
4 a residential household that is less than 10,000.

5 That's our criteria for whether it is a commercial
6 furnace or something else and a residential furnace
7 at this time.

8 Finally we take into account the fuel type --
9 whether it is gas or something else. Obviously, if it
10 is gas, it falls into what's currently being analyzed
11 and in terms of mobile home and non-mobile home RECS
12 provides what type of household it is. So obviously
13 the households are manufactured homes or mobile homes
14 fall into the mobile home gas furnace.

15 In terms of statistics, it is important to
16 point out that RECS 2009 has a lot bigger sample
17 size. It is about 12,000 households that are being
18 sampled from. Out of these 12,000, 5,700 fall into
19 households with a gas furnace and these are the
20 statistics that you can see here and the number of
21 buildings that represents. That represents almost 54
22 million homes in terms of RECS.

1 This gives you a little bit more detail
2 about how we do, in terms of adjustments to the
3 building sample, so I'll go through this a little bit
4 quickly because in the interest of time but
5 essentially the one issue that we face is that
6 obviously RECS 2009 was the building sample RECS in
7 2009 and we wanted to adjust that for the conditions
8 in 2021.

9 So what would be the distribution of these
10 furnaces in 2021 and also we are trying to adjust
11 these in terms of shipments so we are more interested
12 in terms of individual furnaces and where the
13 distribution is. So we make adjustments to the
14 building sample in terms of whether the household is
15 sharing a furnace -- this is the first one. The
16 buildings will -- multiple furnaces we take into account
17 as I have described.

18 Any growth in the market shares up to 2021
19 and we match the historical shipments that we have.
20 AHRI provided previously from 19 -- I believe it was
21 1992 or '91 to 2003 shipments by state. So we used
22 this data to -- kind of -- that's our basis. We don't have

1 any further shipments data segregated by state after
2 that.

3 We also take into account that there is a
4 fraction of households that is reported in RECS that
5 are actually weatherized gas furnaces which are not
6 part of this analysis so we tried to take that out of
7 the sample as well or weight them appropriately so we
8 don't overestimate.

9 And that's further discussed in --
10 actually this is in appendix 7A. So the next is kind
11 of an overview of the whole energy use analysis.

12 MR. BROOKMAN: And we have a question
13 here. How did you handle the cost to remove a
14 non-condensing MHGF and install a condensing MHGF
15 with new venting and condensate removal? That's from
16 Terri Emol.

17 MR. FRANCO: Thank you so much for that
18 comment. We actually passed that quickly just going
19 back to that slide 52. As you can see there's the
20 condensate removal that is taken into account.
21 Further details about the venting which is a little
22 bit different in mobile homes is described in the

1 appendix 8B which is described installation.

2 Basically the venting in the mobile homes
3 is very short. Usually it vents up through the roof,
4 the condensing furnaces usually do the same thing
5 except that it is classic PVC usually and it uses
6 some type of concentric for the direct venting all
7 mobile home furnaces to be directly vented so those
8 are consideration that we are taking into account and
9 they are fully described in the appendix 8D.

10 So obviously I'll be describing this in
11 the slides just to give you a sense of all the
12 different factors that are taken into account and I
13 will go through these all in detail.

14 Again if we start from your right hand side there's a
15 fuel use and an electricity use, which I will be
16 describing separately.

17 Just to note that we do have a separate
18 standard for standby and we take that into account as
19 well. That's part of the electricity use component
20 and all of these different factors and data inputs
21 are part of this model. One of the main inputs again
22 is the RECS energy use data and we will be talking

1 about that in more detail in the coming slides.

2 MR. BROOKMAN: Frank Stanonik?

3 MR. STANONIK: Frank Stanonik, AHRI. I'm
4 sorry Victor, can you go back just for a second to
5 slide 55? So the very last bullet there are you
6 saying that this fact that DOE multiplied RECS by
7 weight of households so are you saying that for every
8 household in the North that had a furnace you are
9 assuming that 97% of those also had an air
10 conditioner, is that what that means?

11 MR. FRANCO: Yeah, I'm sorry. There's
12 probably -- it's not very well written in terms of what
13 that means. That is in relation to weatherized gas
14 furnaces and that's supposed to represent is that in
15 the North only 3% of furnaces are weatherized gas
16 furnaces so it's 3% of furnaces that have central air
17 conditioners. conditioners Based on shipments that AHRI has
18 provided we kind of --

19 MR. STANONIK: Oh it's only weatherized?

20 MR. FRANCO: Only weatherized.

21 MR. STANONIK: Okay.

22 MR. CYMBALSKY: What is says is that there

1 is all of these furnaces 97% are non-weatherized.

2 MR. FRANCO: Correct yes and I'm sorry
3 it's not --

4 MR. BROOKMAN: Dave please?

5 MR. SCHROEDER: This is Dave Schroeder.
6 On the flow chart you have the AFUE of existing
7 furnace which looks like it is controlled by RECS
8 and historical shipment data, can you describe how
9 you make the determination on an individual home
10 basis what the AFUE existing furnace will be?

11 MR. FRANCO: That's actually a very good
12 question and that's a very important detail actually
13 from that analysis. So first, we actually have quite
14 a bit of historical data provided by AHRI about
15 historical shipments of condensing and non-condensing
16 even by efficiency, different efficiency levels.

17 Going back to I believe 1976, 1976-1977,
18 we used that data to kind of tell us what the
19 different levels would be of fraction of say in 1970
20 it would be 65 AFUE types of homes that have 65% AFUE
21 units. More recently we actually have segregated
22 also between condensing and non-condensing by region.

1 So what we essentially do is we select the
2 household and based on all of that data that's
3 regional. We say, for example, you are in a region in
4 the North and RECS says that your household furnace
5 is 10 years old, so that would mean that it was
6 purchased in 1999. So there's a lookup table it goes
7 from 1999, and then it selects based on the likelihood
8 that it would be one of those efficiency levels -- so
9 say, 1999 -- 20% or 30% of furnaces are condensing.

10 So then it would select 30% of the
11 condensing, 70% at a time non-condensing. If it was
12 in the South maybe it is only 10% condensing and 90%
13 uncondensing.

14 MR. SCHROEDER: So is that the same as the
15 way the base case AFUE is assigned? With the
16 exception of this is now not old furnaces -- this is
17 current or future.

18 MR. FRANCO: That is absolutely correct.
19 Then in the base case which we will be describing
20 later we are projecting those fractions to 2021 by
21 region.

22 MR. SCHROEDER: Okay thank you.

1 MR. FRANCO: Thank you for that question.
2 Obviously, provide any more detailed questions in your
3 comments as I said we are going through this very
4 quickly.

5 So fuel uses, obviously the most important
6 component, this is our methodology. Basically we have
7 multiplied burner operating hours by the input
8 capacity. To determine the input capacity, we base that
9 on the household characteristics, historical shipment
10 data of the input capacity and the model availability
11 in the AHRI directory.

12 Essentially we size the household to
13 different input capacity. To determine the burner
14 operating hours we basically determined the
15 building's heating load and divide that by the useful
16 output. What we mean by useful output is in terms of
17 the actual output that is the furnace in terms of the
18 fuel. For those of the electrical components give
19 off some heat and this is all based on the proposed
20 federal standard that we discussed yesterday, all of
21 these equations.

22 Details about this can be found in

1 appendix 7B of the TSD. Let's go into more detail
2 about the building heating load. So we are
3 calculating this for 2021. Just focus the most
4 important component is the actual what is listed here
5 as QYR which is the energy use that is provided from
6 RECS.

7 Let's see the energy use of the heating
8 component. We make adjustments to that later that I
9 will be describing.

10 We multiply that AFUE of the existing and
11 we add the blower heat which is the main heat useful
12 heat that is provided by the electrical components.
13 We do some adjustments which I will be describing and
14 we divided by the furnace count: some households have
15 multiple furnaces, so say if a household has two
16 furnaces their heating load is calculated to be
17 serving -- 50 million BTUs, we assume that each
18 furnace will be 25 million BTUs.

19 And if we are in a case where the furnace
20 is shared between multiple houses we multiply that by
21 the number of units served.

22 MR. BROOKMAN: Frank Stanonik?

1 MR. STANONKIK: Frank Stanonik, AHRI.
2 Victor, I appreciate you might now be the RECS expert
3 but so RECS actually surveys a certain number of
4 households, actually surveys them right. Do you know
5 does RECS ask the question as to whether the
6 household has had significant, I'm going to call it,
7 envelope improvements?

8 MR. FRANCO: Thank you Frank for that
9 question. It does actually. It has quite a
10 significant, yeah, number of questions that I would ask,
11 yep.

12 MR. ROSENSTOCK: Steve Rosenstock, Edison
13 Electric Institute. I guess especially kind of
14 following up on that for the building shell
15 efficiency especially for the new homes built between
16 now and 2021, what assumptions are you making in terms
17 of the improvement in terms of building shell
18 efficiency for the new homes?

19 MR. FRANCO: That is an excellent question
20 that leads actually to the adjustment factors. So in
21 addition to what I have described there are
22 adjustment factors which is the adjustment factor.

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4 One of them is actually to the building shell
5 efficiency which is the second bullet so if you go
6 down to adjustment factors we adjust for the building
7 shell efficiency which essentially comes from the AO
8 2014 what they are assuming between what is in RECS
9 2009 and what would it be in 2021 and so there is an
10 adjustment and further details are on the TSD about
11 how the magnitude of that.

12 MR. ROSENSTOCK: What section of the TSD
13 I'm sorry, I just wanted to double check.

14 MR. FRANCO: This would be in chapter 7
15 and the full actual information is in appendix 7B.

16 MR. BROOKMAN: Yes, please?

17 MR. WHITE: Chuck White, I just wanted
18 clarification. You talk about shared units so we
19 have multiple occupancies with a single furnace
20 serving say two or three apartments so there are
21 different occupancies.

22 MR. FRANCO: That is correct, yes. The

1 RECS has a variable that says if the homeowner has
2 knowledge about the building if the furnace is shared
3 between multiple units that is very common in
4 multi-family situations it could be two or three
5 units.

6 MR. BRUNDAGE: Don Brundage, Southern
7 Company. Your line here says adjusted for changes in
8 building shell efficiency and climate change in 2021.
9 Is that the change in the climate zone maps from
10 ASHRAE and ANSI or is it something different from
11 that?

12 MR. CYMBALSKY: This is John from DOE. So
13 all it is doing is taking the AEO forecast for
14 heating and cooling degree dates, well in this case
15 heating degree days and it is tracking population
16 migration over time.

17 MR. BRUNDAGE: So it is adjusting for
18 climate migration and percentage in each climate zone
19 not changing climate?

20 MR. CYMBALSKY: Correct.

21 MR. BRUNDAGE: Okay, thank you.

22 MR. BROOKMAN: Yes please.

1 MR. WHITE: One quick follow-up I've been
2 encouraged to say. This is Chuck White, PHCC. I am
3 pretty sure sitting here I don't have the books in
4 front of me but the mechanical codes prohibit mixing
5 return air from sleeping quarters from other
6 occupancies so if you have multiple apartments with a
7 common furnace then you are going to replace this
8 according to code, then you are going to have to now
9 put in three furnaces and three systems and I am
10 pretty sure without my code books in front of me but
11 I am pretty sure that is the case.

12 MR. BROOKMAN: Okay thank you.

13 MR. FRANCO: Thank you for that comment.
14 So the last adjustment factor here to discuss is that
15 we are adjusting the climate conditions in 2009 to
16 average climate conditions which we basically assume
17 to be the last or more recent 10 year from NOAA data
18 climate based on the heating degree days so each
19 RECS household has a heating degree days and we had
20 just got on the region to the 10 year average.

21 MR. ROSENSTOCK: Quick question Steve
22 Rosenstock, EEI. So are you including 2014 -- the polar

1 vortex -- in this analysis?

2 MR. BROOKMAN: Thanks for the question
3 Steve.

4 MR. FRANCO: This goes up to 2013, 2014
5 wasn't available for this analysis.

6 Okay so this slide actually summarizes the
7 results that are coming in for the fuel use. So here
8 I just wanted for you to see visually the comparison
9 in the table between the RECS, CBECS data in terms
10 of the fuel use that is reported there versus our
11 calculated values in 2021 for the baseline.

12 So this would be for the 80% furnace. So
13 as you can see there is a significant difference
14 decrease because of these adjustments that I
15 described earlier including for example, building
16 shell efficiency. I also provided the median in
17 value to get a sense of the distribution but as you
18 can see there is this distribution is pretty wide,
19 kind of has a long tail, you can kind of get a sense
20 of all we are dealing with a large building sample
21 and it provides this distribution.

22 MR. BROOKMAN: Paul Haydock from Carrier,

1 who is joining us online, asks a question and the
2 question is how is blower heat determined?

3 MR. FRANCO: I'll be addressing
4 electricity, which will deal with a little bit the
5 blower heat in the next -- so I just discuss that in
6 the next slide.

7 MR. BROOKMAN: Okay.

8 MR. FRANCO: Thank you for that question.
9 Blower heat in terms of -- basically we take into
10 account the furnace fan electricity use. We assume
11 that -- as well as the current test procedure assumes
12 that all of the electricity use coming from the
13 blower is useful heat so we incorporate that into the
14 useful heat component of this calculation for the
15 fuel use.

16 Next we will be describing the electricity
17 use. So there's two main components in terms of the
18 electricity use. There's the active mode and the
19 standby. So what this means is the active mode is
20 when the furnace is on, the standby is when it is
21 off. The standby component is important in terms of
22 the other standby and off mode standard.

1 So let's separate those two. First we
2 have the active mode. So we have three main
3 components, we have the electrical components that
4 are part of the furnace these include the blower, the
5 inducer fan, the electronic condition, those
6 components. We also include auxiliary components and
7 this relates to the question that we had earlier.

8 This is -- we include the heat -- the
9 condensate pumps in here as well. Finally we take
10 into account that there is differential electricity
11 use of the fan during non-furnace operation. What
12 this means is that if the fan is used during the
13 cooling period or as a continuous fan or as kind of
14 providing some air the circulating fan, it is also
15 taken into account.

16 We made the same assumptions as we did for
17 the 2014 furnace fan final rule to determine this, so
18 it is consistent. Going back to the electrical
19 component because this was the question before -- in
20 terms of the furnace fan, we make the same assumptions
21 that we did in the 2014 furnace fan rule and we take
22 into account that there are a lot of -- a significant

1 number of households that have high static pressure
2 and their electricity use is significantly different
3 than would be assumed if you would just use for
4 example the test procedure assumptions about static
5 pressure.

6 So that's already taken into account and
7 that is consistent with the 2014 furnace fan rule.

8 MR. BROOKMAN: Victor we have a question
9 and a comment from Mark Nayes who is joining us
10 online. Mark, we probably have you unmuted at this
11 point.

12 MR. NAYES: Yes I was just going to make a
13 comment again on the multiple -- the single furnace
14 serving multiple occupancies. That is against code,
15 it is a health safety issue that you are not ever
16 going to see that.

17 MR. BROOKMAN: Okay thank you, echoing
18 Chuck's comment thank you.

19 MR. NAYES: Yes he is absolutely correct.

20 MR. BROOKMAN: Thanks, Frank Stanonik?

21 MR. STANONIK: Frank Stanonik, AHRI. And
22 again I am going to apologize, I am going back one or

1 two slides. So you did recognize that, if you will,
2 that the heat coming off the blower is useful heat
3 but I'll say certainly for a non-condensing furnace
4 that's actually installed in the conditioned space
5 shouldn't you be counting any of the electric
6 consumption that occurs during operation as heat to
7 the space?

8 MR. FRANCO: That is correct, that is
9 accounted for in the analysis that is further
10 described in appendix 7B.

11 MR. STANONIK: Oh okay, so okay, I can talk
12 lower okay.

13 MR. FRANCO: Yes sir, I just wanted to
14 focus on the blower because it is the biggest
15 component but you are correct.

16 MR. VERSHAW: Victor, Jim VerShaw,
17 Ingersoll Rand. I have been trying to figure out how
18 -- what you used for blower power. I saw on the
19 earlier flow chart it was average blower power and
20 how you determined what it was in heating and cooling
21 and standby. I couldn't quite figure it out.

22 I looked at table 7B.3.1 that says furnace

1 fan motor consumption by product type and furnace fan
2 size. Is that heating or is that cooling or what?

3 MR. FRANCO: The furnace fan power has to
4 be determined both for the heating use for the
5 cooling, usually it is higher for the cooling and for
6 the continuous fan so there is actually three
7 operating modes that we are considering. We did the
8 same assumptions as we did in the 2014 furnace fan
9 rule so the -- we take into account the sizing of air
10 conditioner, the sizing of the heating and what the
11 power would be.

12 MR. VERSHAW: So if you took a range of
13 static pressure is that right?

14 MR. FRANCO: That is correct.

15 MR. VERSHAW: You took a range of static
16 pressures and then you must have checked typical
17 furnace that would give a certain blower, so if the
18 cooling -- so how does 7B.3.1 -- how does that work
19 into what you did? What are those powers?

20 MR. FRANCO: Right, yes. Thank you for
21 that clarification. These are just for the heating
22 because --

1 MR. VERSHAW: So these are heating.

2 MR. FRANCO: These are just heating yes.

3 MR. VERSHAW: Okay now we are talking
4 about using the new AFUE test procedure which if you
5 have a -- and that's for 2-stage if you have got more
6 than the 58% ratio, you are only testing low speeds
7 so it should only be low speed. There's no way in
8 the world that a 5 ton can almost have a thousand
9 watts at low speed heating.

10 Is this what you used for heating? I
11 think we can get a lot, lot, lot, lot, lot lower than
12 that. Longer hours but a lot lower.

13 MR. FRANCO: I appreciate it and it is
14 actually -- it should be listed they are both the
15 high fire and low fire. What's listed here and it is
16 not quickly labeled, it is just the high fire. The
17 low fire would be --

18 MR. VERSHAW: High fire doesn't make any
19 difference.

20 MR. FRANCO: It would be significantly
21 less in the X13.

22 MR. VERSHAW: Well what went into the

1 analysis?

2 MR. FRANCO: So similar to what we did in
3 the 2014 analysis we have two values, we have the
4 high fire and low fire.

5 MR. VERSHAW: Is there any way we can get
6 that?

7 MR. FRANCO: That's up to --

8 MR. VERSHAW: I have another. Now, you
9 guys are saying that there is a 5% higher power usage
10 by condensing furnaces over non-condensing furnaces,
11 but yet the FER rule says it's 7% or 8% if you look
12 at the two curves, you know the intercepts are about
13 8% apart and I am wondering why you chose 5% here.

14 MR. FRANCO: That's the -- I would have to
15 look at what you are comparing to.

16 MR. VERSHAW: Remember the rule is FER is
17 equal to .44 times something plus a number and the
18 other one was non-condensing and the condensing was
19 .44 times capacity plus a different number, so these
20 same slopes, the curves are apart by 8% -- 7 or 8%,
21 but you just said it was 5% more for condensing and
22 these are supposed to be kind of averages, I don't

1 understand though how those two are different.

2 MR. FRANCO: I really appreciate that.
3 What we need to do is we need to clarify that section
4 a little bit more. It's very condensed so we can
5 provide other details. Everything is consistent with
6 the 2014 if you go to that rule you will see all of
7 the numbers actually the actual values of what we
8 used for different --

9 MR. VERSHAW: And those are actually in
10 the technical document?

11 MR. FRANCO: In the technical document --

12 MR. VERSHAW: In the technical document
13 spreadsheets?

14 MR. FRANCO: No it is in the technical
15 documentation but we could provide that.

16 MS. ARMSTRONG: We'll get it back to you.

17 MR. FRANCO: We will get that back to you.

18 MR. BROOKMAN: Mark Krebs?

19 MR. KREBS: Yeah this is the one I told
20 you I was going to hold you too Victor remember, okay
21 I'm holding you to it. So in order to answer the
22 question basically we have to bring in the whole

1 furnace fan rule which I guess I just want to express
2 at this point you know how frustrating that is.

3 It is no longer bifurcated it is
4 trifurcated or maybe it is quadrifurated I don't
5 know, something like that. But it certainly, you know,
6 the complexity of this rule is just, you know,
7 compounded because of those factors and just for the
8 record and in that record for the furnace fan rule
9 AGA submitted testimony that shows comparison to 80%
10 furnace and a 93% furnace okay, that's not 92 it's 93
11 so you know a little difference there so what they
12 are saying is that electric uses and kilowatt hours
13 for the 80% was up 191 and the 93% it was 687.

14 Now that's a little bit more than 5% I
15 estimate without breaking out my calculator but you
16 know and I'm not saying this is a typical case. They
17 are not saying it either what they are saying is it
18 came out of the AHRI's database and you know and on
19 top of that is this whole issue of static pressure
20 and the duct work, the typical duct work as you call
21 them that really you know reads crummy duct work
22 because typically they are crummy.

1 And so what is that impact you know if you
2 could lay it on a table, what would in some average
3 worst case average and best case maybe as far as the
4 static pressure component from the condensing furnace
5 itself that is additive to that static pressure
6 component of the duct work you know and your papers
7 you did you know good, average and typical or
8 something like that.

9 You know something similar where it is
10 laid out to where people can see what is happening so
11 we don't get frustrated, having to resort back to the
12 furnace rule and that TSD, you know, I think 957 pages
13 of TSD is sufficient in my opinion so I would like to
14 keep it there.

15 MR. FRANCO: Thank you for that comment,
16 we will definitely clarify that.

17 MR. BROOKMAN: Steve Rosenstock?

18 MR. ROSENSTOCK: Steve Rosenstock, Edison
19 Electric Institute. I am also looking at table
20 7D.3.1. There is a part that says furnace fan size
21 ton I think you are saying that is really the air
22 conditioners size that's combined with it so three

1 tons is typical kind of shipment weighted average.
2 You are saying 467 watts for non-condensing, not
3 weatherized gas furnace and then 490 watts for the
4 condensing, that's at the high value right, that's at
5 the maximum heating load?

6 MR. FRANCO: That is correct.

7 MR. ROSENSTOCK: And for the low speed or
8 the low load what are the values, half of that,
9 one-quarter of that, what are we talking about just
10 in terms of relative and then I will have a follow up
11 question.

12 MR. FRANCO: Okay, they are almost half
13 they are about 60% of that. If you had access to the
14 spreadsheet there is just to point out if anybody has
15 access there's a worksheet that is called Energy Use
16 Calcs and in that sheet there is a table that lists
17 those values.

18 MR. ROSENSTOCK: And then I just want for
19 point of comparison for the fans that they are
20 replacing, for the older fans you know for the --
21 I'll say the floor standards, what percentage savings
22 are we talking about in terms of wattage for both

1 high and or low you know? How much of a reduction
2 already for -- I know you are talking about fuel
3 switching but even this rule itself is significant
4 reduction in electricity uses so I am just kind of
5 curious of a general ballpark percentage.

6 MR. FRANCO: Just to clarify, you are
7 comparing a furnace with a PSC motor currently on
8 the market compared to the 2014 standard?

9 MR. ROSENSTOCK: Yeah I'll say a 2019
10 motor versus a 2015 motor, what would be the relative
11 savings about 20%?

12 MR. FRANCO: On average it was between 30
13 and 40%.

14 MR. ROSENSTOCK: 30 and 40%, thank you.
15 So these values are already down, thank you.

16 MR. FRANCO: Yes, correct.

17 MR. BROOKMAN: We have a comment from Paul
18 Haddock, maybe it's a question. How are the blower
19 on and off delays handled between non-condensing and
20 condensing furnaces? The 103 standard designs
21 shutter off delay for condensing that it does for
22 non-condensing.

1 MR. FRANCO: Yes we do have blower on/off.
2 I'm trying to take a look if I can answer the
3 question. We will get back to that in the future.

4 So here are the standby and the standby
5 takes into account the burner operating hours,
6 according to operating hours and also the continuous
7 fan operating hours as well. So here in terms of the
8 non-weatherized gas furnaces AFUE standards this is
9 the overall result in terms of fuel use and
10 electricity use. We have decided the results between
11 the national North and rest of country.

12 So I'll stop a little bit in case there is
13 any questions because this is kind of the conclusion
14 to the energy use.

15 MR. BROOKMAN: Jim?

16 MR. DELASKI: I don't understand why
17 things go down like they do and then back up but I
18 think that I don't know enough about what went into
19 it and so once you get me that maybe I will
20 understand it or I will be able to ask a smarter
21 question.

22 MR. FRANCO: Yeah let me point out one

1 that might be an obvious -- you can see 98 there's a
2 negative value there. That's a different technology.
3 We are assuming that that is already at kind of the
4 max tech ECM multi-stage modulating that usually more
5 operating hours associated with electricity and
6 that's why you see a negative value on that one.

7 We will try to clarify so you can provide
8 comments.

9 MR. BROOKMAN: Frank Stanonik?

10 MR. STANONIK: Well, this particular slide
11 this will be the first opportunity so I am going to
12 raise the question. So in the NOPR in the description
13 of the trial standard levels as presented there is
14 identified at the trial standard levels 1 and 2
15 looked at the North and rest of the country
16 separately and then when you get to trial level
17 standards 3, 4 and 5 it appears that it only looked
18 at national average.

19 And yet, if you look at this slide, the rest
20 of the country which I will choose to call the South
21 the estimated consumption of just the fuel use is
22 about 70% of what is the national average and so I

1 guess I am trying to understand why trial, well
2 basically based on the way the trial standard levels
3 are presented why didn't DOE do the separate analysis
4 of the effect of condensing furnace requirement on
5 the South?

6 MR. CYMBALSKY: They did.

7 MR. STANONIK: But that is not what the
8 standard levels are.

9 MR. CYMBALSKY: Frank it is a national
10 standard but it is evaluated you know North, South
11 and everything but it is a national 92 it is not an
12 80/92.

13 MS. ARMSTRONG: This is Ashley from DOE.
14 So it's just how we are talking about the levels
15 right, it is the difference between the first couple
16 that you mentioned there's a regional standard in
17 there which would have different requirements for
18 different regions of the country versus a national
19 standard.

20 It doesn't necessarily mean that national
21 averages were used, they are still built off the same
22 fundamental analysis but it is the difference between

1 the TSL considering your regional standard versus a
2 national standard.

3 MR. FRANCO: This is Victor Franco.

4 MR. BROOKMAN: Michael McCabe?

5 MR. MCCABE: Michael McCabe. Victor is
6 there any rebound effect build into the life-cycle
7 cost analysis that is the different efficiency
8 levels, the building heating load the same?

9 MR. FRANCO: Thank you for that question
10 and in the LCC analysis we do consider rebound
11 effect. We assume that the economic benefit of the
12 increased comfort is equivalent to the energy
13 consumption so we don't think in terms of economics,
14 that into account when we go to the NIA analysis we
15 do take into account the rebound effect and we will
16 talk about the magnitude of that when we talk about
17 the national impact analysis.

18 MR. MCCABE: Would you repeat again what
19 is central to life-cycle costs? Because when you
20 start talking about the economic benefit --

21 MR. FRANCO: Thank you, what I mean by that
22 is a consumer is using the furnace longer to provide

1 greater comfort. One way to actually put it in
2 economic terms what that consumer benefit is, is just
3 to say that it is equivalent to the actual energy
4 cost.

5 MR. CYMBALSKY: So this is John from DOE --
6 let me step in. I think what Michael is asking is
7 will people adjust their thermostats if they buy a
8 more efficient piece of equipment is that your
9 question? The rebound you are looking for?

10 MR. MCCABE: Yes.

11 MR. CYMBALSKY: Did you use an adjustment
12 factor?

13 MR. FRANCO: Not for the LCC but the NIA.

14 MR. CYMBALSKY: So not in the LCC.

15 MR. MCCABE: Thank you.

16 MR. BROOKMAN: Dave?

17 MR. WINNINGHAM: This is Dave Willingham
18 with Allied Air. Just to clarify on the electrical
19 consumption -- until you get to TSL4, electrical
20 consumption appears to be going down as given the
21 fact that fan energy goes up with higher efficiency
22 and you have condensate pumps and heat tape on 90%

1 can you explain that?

2 MR. FRANCO: Yes, thank you and I will be
3 clarifying that in the documentation but that is an
4 important question. What actually happens is that we
5 are assuming that the input capacity of the furnace
6 is constant for all of the efficiency levels, so the
7 actual operating hours decrease once you get to
8 higher efficiencies so just to put that in more
9 concrete.

10 Say you have an 80% efficient furnace and
11 you are 80 million BTUs, your output is 64. Once you
12 go to a non-condensing we are assuming that you are
13 using the same input capacity. In this analysis and
14 that is the reason why you kind of see this effect.

15 MR. WINNINGHAM: This is Dave with Allied.
16 Just a follow up question -- you know the load is the
17 load is the load and wouldn't you size it according
18 to output capacity not input capacity to -- I mean if
19 your heat load is whatever it is you will size it
20 according to the output that is needed to maintain
21 the load not the input.

22 MR. FRANCO: Thank you and please submit

1 comments in that regard. We would really appreciate
2 that. What is happening in this analysis we have
3 gotten some contractor feedback from the stakeholder
4 input that contractors what they do is they generally
5 just size based on what's the product so please put
6 your comments that so if we need to correct it we
7 will correct that.

8 MR. BROOKMAN: Neil go ahead.

9 MR. LESLIE: Neil Leslie, GTI. I would
10 like to get a little more clarification on that last
11 item related to the use of a rebound effect in the
12 NIA but not in the LCC. Could you explain -- first
13 of all, do I have it correct that there is no rebound
14 effect included in the LCC analysis spreadsheet is
15 that -- I just want to make sure I'm hearing it
16 correctly.

17 MR. FRANCO: That is correct yes.

18 MR. LESLIE: And there is a rebound effect
19 17% I don't remember what it is exactly, whatever
20 that rebound effect would be somewhere in that part
21 of town in the national impact analysis, I just want
22 to make sure I have all of that exactly correct,

1 right?

2 MR. FRANCO: That is correct, yes.

3 MR. LESLIE: Okay whatever that number is,
4 I don't necessarily care exactly what it is but so I
5 would like to know why it is in the NIA but not in
6 the LCC?

7 MR. CYMBALSKY: Let me try to tackle the
8 consumer choice here. So if I am a consumer and I am
9 evaluating an efficiency of 80 and an efficiency of
10 92 and I'm comparing what the energy use of those two
11 will be, I don't think I'm factoring in the fact of I
12 am going to adjust my thermostat higher, around 92
13 versus 80 when I do the math in my head, so I think
14 fundamentally that's why you would separate that.

15 Now once the unit is in your house you
16 could react to the fact that your marginal cost of
17 heating your home has changed and then mentally you
18 will go and say wow it's a lot cheaper, maybe I'll
19 inch it up a degree or two. So fundamentally that's
20 why you would do it that way.

21 MR. BROOKMAN: We have a question from
22 Everett Shorey from online. His question is why is

1 the mean electricity use in the ELs 1 through 4 727
2 to 957 kilowatt hours per year while the median is
3 330 to 355 and the mean for EL0 is also 349
4 (referring to the numbers in the LCC model on the
5 website).

6 MR. FRANCO: I didn't fully get the first
7 part, could you just repeat that?

8 MR. BROOKMAN: John Cymbalsky is saying we
9 need to get back on that one and then another
10 question from Paul Haddock. Is the blower power
11 consumption of 90% the same as 92 the same as 95% or
12 does DOE add additional power needed for higher AFUE
13 levels?

14 MR. FRANCO: So that's a great question.
15 We do have higher power use in terms of going from
16 non-condensing to condensing. We don't have in terms
17 of going from say 90 to 92 a difference in the
18 electricity consumption but it is higher between
19 non-condensing and condensing.

20 MR. BROOKMAN: Thank you. Frank Stanonik?

21 MR. STANONIK: Frank Stanonik, AHRI. I'm
22 going to follow up Neil's question and I understand

1 what John said but if in I would say in just the same
2 way and I don't disagree with this that DOE is
3 looking at RECS data to kind of see okay what is
4 consumption that actually occurs in the field, I
5 think that in terms of life-cycle cost if in fact that
6 consumer when they do get a more efficient furnace
7 decide that they want to have their house warmer they
8 in fact have changed what they will pay on a monthly
9 basis for the fuel they have changed the relationship
10 of the benefit in cost of reduced energy cost
11 compared to what they paid for that product and I
12 disagree with the conclusion that well that increase
13 comfort has a monetary value which we will just
14 assume totally balances what they have accepted as a
15 higher bill.

16 I think that's a little bit subterfuging
17 the life-cycle cost analysis because that consumer in
18 fact whether they knew it or not they just extended
19 out how long it is going to take them to pay back
20 what they paid for their new furnace, the higher
21 efficient product.

22 MR. BROOKMAN: Andrew deLaski?

1 MR. DELASKI: I disagree with you Frank.
2 If a consumer chooses to pay \$10.00 for something it
3 is because they value that something at \$10.00. In
4 fact economic theory will suggest that that is the
5 minimum they value it at. In fact if we are able to
6 do some willingness to pay evaluation I would find
7 this is a very conservative number.

8 People turn their thermostat up because
9 they value that. If Gary Fernstrom was here who has
10 been at many of these proceedings, he has made this
11 point time and time again in these proceedings that
12 when a consumer chooses to use something more because
13 it is more efficient because the consumer values
14 that.

15 And for us to say well in the consumer
16 economic analysis say well we are just going to throw
17 that out and ignore that value would be a disservice
18 to the consumer for getting a value. Now as an
19 energy efficiency advocate I wish we were getting the
20 energy savings but the fact is that consumers when
21 things are more efficient they use them more.

22 We can debate the rebound effect. It exists

1 undoubtedly. The size of it is widely debated. The
2 Department says 15% in this proceeding. I think it's
3 probably too high. Steve Nadel's work says it should
4 be 1 to 12% is the range that is discussed in the TSD
5 but to say that that has no value to consumers,
6 because they are now warmer you know that's just
7 ignoring the practice of consumers and I also think
8 it's ignoring the fact that it is probably a very
9 conservative estimate because they probably evaluate
10 more but they didn't have to pay more.

11 MR. BROOKMAN: Jim?

12 MR. VERSHAW: Jim VerShaw. I guess the
13 reason it comes up is we are looking at energy
14 savings that we know aren't exactly right because of
15 the rebound effect whether it is whatever and --

16 MR. DELASKI: And that's why I think that
17 it is proper that the government accounts for it in
18 the NIA. So when we talk about the quad saved we are
19 not counting it.

20 MR. VERSHAW: So when you do the simple
21 payback or the payback for the home owners, does that
22 include the rebound effect or not? I was making a

1 point by asking a question, so it's not in there so
2 if you look at that, if I remember right we are in
3 the 7 to 8 year payback for this rule not including
4 the rebound effect. So it's really 1 to 15% longer
5 than that, whatever that would be.

6 MR. DELASKI: I disagree because they are
7 getting value right, they are getting a value in
8 improved warmth. They are choosing to select.

9 MR. VERSHAW: Show another column with how
10 much they are spending more.

11 MR. DELASKI: And some consumers think
12 that's election and some don't so this is an average
13 value.

14 MR. VERSHAW: And they have a Crystal Ball
15 attachment for this thing they can do that.

16 MR. BROOKMAN: Yes Steve Rosenstock?

17 MR. ROSENSTOCK: Steve Rosenstock, Edison
18 Electric Institute. I'll just looking at EL2 for the
19 national number going into this. We talk about on
20 the fuel use side 55 million BTUs for natural gas at
21 a dollar a therm that's \$55.00 a year. On the
22 electricity side 13.9 kilowatt hours that's about 12

1 cents, national average it is about \$1.74 per year.

2 So you add those up it is about \$56.00 a
3 year. What percentage will consumers give back in
4 terms of rebound effect, that's a question I don't
5 know. I am sure there are a lot of studies that show
6 numbers all over the map like Andrew was saying but
7 in terms of will it make energy savings, cost
8 savings? No. Will it vent it? Yes.

9 How should it be accounted for? Right now
10 and in other rulemakings you know again I don't think
11 they accounted for rebound effect for like heat pumps
12 so you know to account for it here and not know their
13 products doesn't make, it's not really analytically
14 consistent.

15 MR. BROOKMAN: Yes, Aniruddh?

16 MR. ROY: Aniruddh Roy, Goodman. Victor,
17 on this table with the 80's, are they all using the
18 BPM, the constant torque BPM motors?

19 MR. FRANCO: This would be actually X13.

20 MR. ROY: X13?

21 MR. FRANCO: X13 yes, okay. So moving on,
22 this is I think we had sufficient discussion.

1 MR. BROOKMAN: I think we have covered
2 these materials sufficiently we are going to move on.

3 MR. FRANCO: So there are three slides, in
4 terms of energy prices. If we could limit the
5 questions to the last slide in terms of energy prices
6 that would be good but let me know if you have any
7 questions. So basically this first slide provides
8 the references that we are using in terms of this
9 aggregated energy prices that we are using in the
10 analysis.

11 What I mean by that, is we have energy
12 prices for each household based on the region of the
13 country they are at and by month. The energy prices
14 that we use in terms of calculating energy savings
15 are marginal in terms of electricity and natural gas
16 and the values will be described later.

17 All the references in terms of getting
18 these values come from EIA data as it says here and
19 it is also in the TSD and the baseline -- the year
20 that we are using to start with is 2012 that's the
21 latest data that is aggregated by state for all of
22 these prices. Next after we have that disaggregated

1 we use EO 2014 data to project the values into the
2 future from 2020 to 2040.

3 Then we use trends after that to project
4 the values after 2040.

5 MR. ROSENSTOCK: Can we comment?

6 MR. BROOKMAN: Please.

7 MR. ROSENSTOCK: Steve Rosenstock, Edison
8 Electric Institute. For all the people here in the
9 room, this chart is showing an estimate of the real
10 prices, not the nominal prices. These are in 2013
11 dollars, so it is assuming that prices are going to
12 increase above inflation from 2015 to 2040 and I have
13 issues with that, that's another story.

14 MR. FRANCO: Thank you for that comment.

15 MR. BROOKMAN: Mark?

16 MR. KREBS: Yeah I have issues with that
17 too.

18 MR. CYMBALSKY: This is John from DOE. So
19 these are straight from the AEO, so you know we are
20 not forecasting prices that's not what we do in the
21 shop so you know this is the government projections
22 on energy prices which is what we use.

1 MR. BROOKMAN: So anybody that had
2 additional thoughts on this or their own projections
3 they can send them forward, Mark?

4 MR. KREBS: Yeah, well, you know the issue
5 is marginal costs, you know, these are marginal costs
6 and what you call marginal costs really aren't
7 marginal costs either. You know Steve Rosenstock and
8 I were in the room along with the President of APGA
9 Bert Kalisch when in 1998 when the whole concept of
10 consumer marginal energy rates was first hatched.

11 DOE draft report was issued and never
12 really published. LBNL has a web page on marginal
13 energy rates and you are still not doing it right.
14 It's tail block rates we are talking about okay, they
15 are mentioned in some of these papers that Victor
16 helped to offer but that is the right way to do it
17 and I understand it is difficult to do, you know to
18 track real tariff filings and look at the tail block
19 rates and how a change in consumption is -- comes
20 across to consumers in their utility bills but that
21 is the way to do it.

22 You know you have time to tear down 30

1 furnaces I think you have time to do this.

2 MR. BROOKMAN: Harvey Sachs?

3 MR. SACHS: Mark, this is Harvey Sachs. I
4 certainly understand where you are coming from. Your
5 advocates have chafed with the AEO forecast for many
6 years and I guess we sort of became reconciled to the
7 fact that they are on average equally detrimental to
8 everybody and that it is sort of -- well one of the
9 rules of the game like it is not 90 feet along the
10 baseline.

11 MR. KREBS: We had an advisory committee
12 you know that I was on and Steve was on it and you
13 know this is one of the things that we actually
14 concluded you know and came across you know all in
15 favor of doing this and it hasn't been done, you know
16 and that was 1998. I think it is time to start doing
17 it.

18 MR. SACHS: Its past is so mundane.

19 MR. KREBS: I appreciate you trying to
20 inject some humor in this but what I am talking about
21 is looking after my customer's best interest, okay it
22 is a big deal you know. We are talking you know

1 marginal true tail block rates are about 50% of what
2 DOE has forecast and then those get inflated for 21.5
3 years, it is a major impact okay and I don't think
4 it's doing consumers any favors at all.

5 MR. SACHS: I understand that but I want
6 to make one other comment. This is Harvey. We have
7 seen some major churn in how rates and tariffs are
8 set, particularly on the electric side over the last
9 couple of decades and that is the inherent
10 uncertainty as we try to look forward to those two
11 decades and we have been comfortable and I am happy
12 to look at that analysis and would appreciate the
13 chance to read it because I know it has changed my
14 life.

15 MR. BROOKMAN: Okay, we are moving on now.

16 MR. FRANCO: Thank you for all of those
17 comments. So just one to go to the next slide. This
18 is the average prices applied in the analysis. As
19 you can see the average is very different for the
20 marginal cost and appendix the energy price of --
21 which I believe is appendix 8E we do provide
22 comparison between tariffs analysis we did get from

1 APGA some tariffs and we do a comparison of those to
2 our analysis so if you want to read on that please
3 provide comments in that regard.

4 Next we will be discussing repair and
5 maintenance costs of repairing different components
6 in the furnace. You do this by different components
7 for example the fan blower is one of the components
8 we consider, failing during the lifetime of the
9 furnace. The cost and frequencies come from various
10 sources including RS means, manufacturer literature
11 and a survey from American Comfort.

12 MR. BROOKMAN: Yes Jim VerShaw?

13 MR. VERSHAW: Jim VerShaw. So Victor, are
14 the 2252 for a 90% for all the 90's 90 plus furnaces,
15 that's the adder each year that you just assume this
16 furnace will have for 21 years?

17 MR. FRANCO: That is correct.

18 MR. VERSHAW: So it's \$22.52 a year times
19 21 and that is what they will spent on the air?

20 MR. FRANCO: And this is an average value
21 again, some households, if for example, their furnace
22 fan fails and that is a significant cost. Some

1 others --

2 MR. VERSHAW: What would the failure rate
3 that you assume for the furnace fan and for the
4 controls and all of that, do you have that, is that
5 written out?

6 MR. FRANCO: That's written out in the TSD
7 I believe for furnaces it is around 40%.

8 MR. VERSHAW: You actually didn't have it
9 for furnace fans unless I had to back out -- you had
10 how much of a cost to fix the fan blower \$274.00 and
11 3.43 hours of labor but it doesn't say what the
12 failure rate would be. Maybe it would be nice to
13 know what that considered because I did turn in
14 failure rate numbers on the difference between PSCs
15 and DC motors under the FER and these are actual
16 numbers that we are seeing and also I turned in what
17 I thought replacement motors should cost and I'm not
18 sure you can get a replacement X13 motor for \$274.00
19 as a homeowner.

20 And I turned in that information also and
21 you might want to look back at that and see if that's
22 matching that. And then the other thing that I am

1 wondering about is we are using a brand new power
2 supply in this level, in the TSL in the 92% level or
3 maybe all of them. What was the failure rate on
4 that?

5 And if it fails how much does it cost to
6 replace it, is that factored in?

7 MR. FRANCO: In terms of the fan component
8 --

9 MR. VERSHAW: Switch and power supply.

10 MR. FRANCO: So we don't have that --

11 MR. VERSHAW: We don't have it as a
12 product we only have a transformer.

13 MR. FRANCO: Yeah, we don't have it as a
14 separate component.

15 MR. VERSHAW: I'm really -- whenever you
16 use new technology you probably have a learning curve
17 right. And probably how steep do you want the price
18 of it, well it is going to be way up here and a high
19 failure rate at the beginning and it is going to get
20 better over time so I think you need to take a look
21 at that. I don't even know where they are used or
22 what they are, to tell you the truth I'm not a double

1 EE so it would be interesting to find that out.

2 MR. MURPHY: Can I just go back to
3 marginal prices for a second and something that
4 Victor you mentioned that you had said that you had
5 use of tariff information that you got from APGA.
6 AGA also submitted a marginal cost study as well that
7 actually indicated about a 25% differential between
8 average and marginal. Did you incorporate that in
9 your analysis as well?

10 MR. FRANCO: We did do the comparisons for
11 our results between those two sets of data, yes, it
12 is included.

13 MR. BROOKMAN: Frank Stanonik.

14 MR. STANONIK: Frank Stanonik, AHRI. So
15 on the maintenance cost you do talk about additional
16 maintenance costs associated with condensate
17 withdrawal. So to my very limited knowledge in this
18 area I do not believe that the condensate pump that
19 in some cases will be required because of the
20 installation of a condensing furnace that the
21 lifetime of the pump is the same as the lifetime of
22 the furnace so does this include in fact some point

1 the full replacement of the condensate pump?

2 MR. FRANCO: Yes, it includes both the
3 condensate pump and the neutralizer filter in the
4 main --

5 MR. BROOKMAN: We have a question from
6 online: Terry Small asks why is the repair cost for
7 manufactured housing gas furnace so much lower than
8 for non-weatherized gas furnace?

9 MR. FRANCO: We'd have to get back to
10 exactly the reason. One reason is they are actually
11 using different components which is there is a PSC
12 motor instead of X13 motor as the baseline, that's
13 probably the primary reason.

14 MR. BROOKMAN: Yes Dave Schroeder?

15 MR. SCHROEDER: This is Dave Schroeder.
16 It looks like from the TSD that proprietary data was
17 used to determine maintenance frequency across the
18 board. Is there any way that that source data can be
19 made available?

20 MR. FRANCO: Thank you for that question I
21 was actually going to get to that. So we do use this
22 2008 American Home Comfort survey data to --

1 especially for the maintenance cost. We try to use
2 as much publicly available data as possible. In this
3 case this was the only source. We do in the appendix
4 related to the main sensory -- we do put in all of
5 the data that we actually use so these are aggregate
6 values that are coming from the data.

7 We do publish those we are allowed to
8 publish that. We don't have access to the raw data
9 but that is what we use is published and how it is
10 actually used in the analysis. We combine that with
11 RECS data which actually gives us how often an owner
12 for example will maintain if he does maintain the
13 furnace regularly or not and how we use American
14 Comfort survey is kind of just aggregate that in
15 terms of years. So once RECS tells us if the owner
16 is going to maintain it regularly American Comfort
17 survey kind of gives us a sense of is that yearly, is
18 that every couple of years is that every five years.

19 MR. BROOKMAN: John Cymbalsky?

20 MR. CYMBALSKY: John from DOE. So there
21 was a question that was just asked was part of the
22 APGA submission and that's under questions 1 and 2

1 under the related to maintenance costs so that's the
2 answer to those two questions.

3 MR. BROOKMAN: We have a question, a double
4 question from Jim Moore, Jim who is online, Jim Moore
5 asks has DOE used more frequent fan motor failures
6 with the move away from PSC motors or are you using
7 PSC failure rates with the new motor technology?

8 MR. FRANCO: Thank you for that question.
9 We are actually being consistent with the 2014
10 furnace rule and we are having an increased failure
11 rate and that is consistent with the final rule.

12 MR. BROOKMAN: Okay Rick?

13 MR. MURPHY: Victor just going back to the
14 reference to [American] home comfort study and I recall
15 trying
16 to look through it in my notes that there was a
17 reference that in its cost and other areas of the
18 home comfort study that we are trying to gain access
19 to but I believe there was also in addition to the
20 [American] home comfort study that relied on energy
21 consultants
22 to develop some numbers so what I am trying to get at

1 was it strictly the data or the home comfort study or
2 was it a combination of that along with other input
3 and if so how do we get access to the intelligence
4 that came out of that.

5 MR. FRANCO: I really appreciate the
6 comment. Whenever we get input for example from
7 expert consultants or some consultants, we do publish
8 what their assumptions how we use that data. In the
9 case of maintenance it is mainly to validate more or
10 less based on the understanding of the approach.

11 It is not in terms of providing any
12 additional data. In terms of the actual methodology
13 as described there as I described we used American
14 comfort surveys for data, we use directly from that
15 survey we did publish there and data that we are
16 getting from RECS which is publicly available we do
17 publish the fractions as well there so we try to not
18 have anything that you can't get access to as much as
19 we can.

20 But please provide any comments if you
21 find something that is -- you think that is not well
22 understood and we will try to answer that.

1 MR. BROOKMAN: Neil?

2 MR. LESLIE: Neil Leslie, GTA. There's
3 one part of that question, the first question I just
4 want to make sure I don't remember hearing an answer
5 to and that is why was only one year of the study
6 data used when there were four years of data used in
7 other parts of the analysis.

8 MR. FRANCO: And I appreciate that
9 question. We had direct access during that time to
10 just one survey of that data when we looked back and
11 looked at the other surveys the data was very
12 similar, so potentially it could be used multiple
13 years. For this we only had access for that one
14 single year the data for this particular variable.

15 So now we are going into the inputs
16 lifetime and discount rates. So first, let's discuss
17 lifetime. We use a distribution of lifetimes we use
18 the method that uses survey data that comes from
19 American Housing Survey and RECS. American Housing
20 Survey provides how many furnaces are installed in
21 the U.S.

22 It's fairly robust survey that is

1 conducted by HUD [Housing & Urban Development] and Census
2 every couple of years so that gives us a better number in
3 terms of total furnaces that are in the nation and we use
4 also RECS data in terms of the age of the equipment that is
5 currently being installed to give us also a sense of
6 this distribution.

7 We combine that with manufacturer's
8 shipment data. The manufacturer's shipment data is
9 data that has been provided by AHRI throughout the
10 years and also is publicly available on their
11 website.

12 For this analysis we actually did a
13 modification based on the previous analysis. In
14 discussions with AHRI we were able to understand
15 better what the shipments included. The shipments of
16 the AHRI do not include weatherized gas furnaces so
17 they actually provided for about a 6 or 5 year
18 period. Recent period they provided weatherized gas
19 furnace shipments.

20 Adding those shipments to the overall
21 shipments give us a slightly lower value in terms of
22 annual lifetime compared to the 2011 DFR and the

1 Census question from AGA partly.

2 MR. CYMBALSKY: This is John from DOE. So
3 this would be question 8 from the APGA docket
4 material relating to the switching logic.

5 MR. FRANCO: In addition to that we
6 provide an appendix in the lifetime appendix we do
7 provide the different references that we used to
8 compare. These are 15 references that we compare
9 this lifetime value and we believe that this is an
10 agreement to those other references consistent with
11 this value.

12 This is in appendix 8G. Next we discussed
13 the discount rates. So discount rates are used to
14 convert operating costs, lifetime operating costs
15 into present value. We use another publicly
16 available data source that comes from the Federal
17 Reserve Board it's called a survey of consumer
18 finances. For this analysis we used multiple years
19 from 1995 to 2010. It comes out every three years.

20 We disaggregated these by -- the discount
21 rates by income for this analysis. This is different
22 from the 2011 analysis, as you can see they vary.

1 This is the average, we do have distributions and the
2 distributions are available in the discount rate
3 appendix in chapter 8.

4 MR. BROOKMAN: Steve Rosenstock?

5 MR. ROSENSTOCK: Steve Rosenstock, EEI
6 please refresh my memory the highest income group is
7 1 or 6 just out of curiosity?

8 MR. FRANCO: Thank you for that
9 clarification. The highest income group is 6, low
10 income is 1, the lowest income group.

11 MR. ROSENSTOCK: Thank you.

12 MR. FRANCO: These are percentiles just to
13 clarify so income group 1 represents zero to 20% and
14 the highest income group is 90%.

15 Next we will be discussing the base case
16 efficiency distribution. There is actually two
17 slides for this.

18 MR. BROOKMAN: Mark?

19 MR. KREBS: I apologize but this is
20 another big one on my list and the last big one for
21 the record. Discount rates, okay there was in the
22 furnace fan rule which I did review, at least the

1 filed comments, there was a very interesting one from
2 George Washington University regulatory study center
3 and she took a look at discount rates in depth and
4 with a bunch of economists that she cited showing
5 discount rates that should be like in the range of
6 100% maybe higher.

7 And these rates totally reverse the
8 aggregate or individual consumer savings, however you
9 want to cut it and you know you go back to 3% and you
10 go back to 7% you know but as I recall you know and
11 you quote the OMB but as I recall OMB circular 8094
12 also recommends using other discount rates to show
13 the sensitivity of the estimates to the discount rate
14 assumption.

15 That's a direct quote out of my Laclede's
16 comments for the DFR. And my question then is you
17 know how have you actually looked at you know these
18 situations for a growing part of American population
19 who is dropping out of the middle class it seems. You
20 know where is that?

21 MR. FRANCO: Thank you so much for those
22 comments. So just to clarify I think the 3% and 7%

1 that you are referring to is what is applied in the
2 NIA analysis and we will be discussing that later.
3 In terms of what is supplied in terms of the LCC the
4 consumer level, these are the rates derived from this
5 analysis for the descriptions in the TSD of how that
6 is derived. There is a distribution so there are
7 some households that have in the low income group
8 very high discount rates that are applied when their
9 household is sampled.

10 You can look at the distribution and you
11 can see that it's significant so there is a
12 distribution but these are just average values.

13 MR. KREBS: Okay so the worst case kind of
14 gets blended in with the average and everything is
15 averaged.

16 MR. FRANCO: No, no, every household is
17 applied a specific discount rate so there are
18 households that have 100, 150% discount rate.

19 MR. KREBS: All right.

20 MR. BROOKMAN: Mark Naves who is joining us
21 online has a question or a comment, Mark go right
22 ahead.

1 MR. NAYES: Yes going back to that filter
2 and maintenance replacement for the costs -- if I put
3 in a high efficient you know standard filter that is
4 supposed to last a year that's \$50.00 right there,
5 that's more than we have got down for the maintenance
6 cost. How am I supposed to pay a guy to go out there
7 and perform maintenance on the system?

8 MR. BROOKMAN: Okay, okay Mark thanks.

9 MR. FRANCO: Thank you.

10 MR. BROOKMAN: And we also have a comment
11 or a question from Everett Surey. It is how do you
12 deal with the fact that the AHS survey data if
13 analyzed by the NAHB shows that the average tenure in
14 a house is under 20 years and well under that in the
15 South and West.

16 MR. FRANCO: We don't -- we analyze just
17 the furnace in terms of the person occupying it could
18 be over the years multiple owners, some of your
19 comments.

20 Okay so moving on to the next topic. The
21 base case efficiency distribution is a major
22 component of the LCC and this is the last in terms of

1 the LCC components before going to fuel switching
2 which will have a huge amount of slides so there are
3 two slides here. The first describes more or less
4 the process that we are using and the data sources.

5 So, the base case efficiency distribution
6 describes -- reflects the projected market shares of
7 products at different efficiency levels in the
8 absence of standards. This absence reflects that not
9 all consumers purchase products at the current
10 minimum efficiency level and that it recognizes that
11 some consumers already purchase products at a higher
12 efficiency level.

13 DOE projected its market shares for 2021
14 based on historical shipments data. Some of it
15 provided by AHRI, also we have the sources here also
16 Energy Star shipments for the years that we didn't
17 have data from AHRI directly, we had historical data
18 from 1980 to 2009. From 2009 we used Energy Star
19 data, 2012 and also we disaggregated between
20 efficiency levels of the condensing side from the
21 latest AHRI certification directory.

22 So the results are shown here in terms of

1 disaggregated base case efficiencies for different
2 markets. You can see that there are differences
3 between North and South and between replacements and
4 new construction. We did get feedback from
5 manufacturers in the manufacturer interviews but
6 there were differences in terms of new construction
7 in terms of the venting market share so there is a
8 larger fraction of furnaces that are below 95 as you
9 can note in the North in the new construction versus
10 the replacement.

11 So for example here you have 32% in new
12 construction and 15% at 92 level. The overall
13 fraction of condensing is fairly close between the
14 two but distribution between the efficiency is
15 different.

16 MR. CYMBALSKY: Okay so we think this
17 answers from the docketed questions priority question
18 A and then questions 1 through 4 related to the base
19 case AFUE efficiency from the docketed APGA
20 questions.

21 MR. BROOKMAN: Thank you John. Frank
22 Stanonik?

1 MR. STANONIK: Frank Stanonik, AHRI. The
2 one thing I am not tracking here in the previous
3 slide so you had shipment data from us non-condensing
4 condensing for quite a few years. I understand you
5 had historical shipment by states from us back up to
6 2003 or something like that but then you slipped in
7 here that you are still using somehow our directory
8 listings as a basis for shipments distribution.
9 Where does that fit into this table?

10 MR. FRANCO: Sure thank you for that. I
11 went really quickly through that. Basically we have
12 all the information about the fraction of condensing
13 versus non-condensing. We don't have for a lot -- I
14 think we only had one for 2002 - 2003 year -- a
15 disaggregation between the different efficiency
16 levels in terms of condensing so to disaggregate
17 between them we used the latest AHRI directory.

18 MR. STANONIK: So are you presuming that
19 the same distribution of listings by efficiency
20 translates to shipments?

21 MR. FRANCO: Partly. Let me explain it's
22 more detailed in TSD but maybe I can do it simply

1 here. For the North replacements we do exactly but
2 then we do modify that for the North and the South.
3 The Norths new construction and the South as well
4 because of manufacturer input in terms of those
5 markets.

6 MR. BROOKMAN: Steve Rosenstock?

7 MR. ROSENSTOCK: Steve Rosenstock, Edison
8 Electric Institute. I'm just kind of curious you
9 know I am looking at the 95% numbers and it says
10 replacement 45% in the North and 5.5% for 90 AFUE and
11 you know but you look in the South and the numbers
12 are a lot closer. They are flipped for some reason
13 and I am just kind of curious the reason for the 95%
14 market having such high market shares is that because
15 of an incentive program or is that because they
16 already have 95% AFUE furnaces existing by 2021?

17 MR. FRANCO: That is correct. One of the
18 main drivers we think in the future especially is the
19 Energy Star program. Energy Star currently has 95%
20 levels for the North and 90% level for the South.

21 So the South is mainly in the lower AFUE
22 in the North you are going up to 95 because of that

1 incentive to go to 95.

2 MR. BROOKMAN: Aniruddh?

3 MR. ROY: So on slide 68 you mentioned the
4 AHRI directory as being the source as well as the
5 shipments collected by AHRI so how were you able to
6 purge in your shipments analysis the PSCs and the
7 80's and forecast the shipments past 2021 based on
8 that data? Because that data also captures that
9 market.

10 MR. FRANCO: We are only considering in
11 terms of condensing market and yeah there are some
12 PSCs but we are only looking at the AFUE in terms of
13 that. We assume that the market still will be just
14 the AFUE would be similar distribution, just looking
15 at the AFUE of those units, not the motor.

16 MR. BROOKMAN: Mark Nayer has a comment and
17 he is joining us online, Mark go right ahead.

18 MR. NAYES: Yes I was just going to
19 comment on those percentages on replacements in the
20 North. At the time we had the very large federal tax
21 credit and we also had some very nice gas incentives
22 for high efficient furnaces and those are very

1 accurate to what we have been seeing but I am just
2 kind of wondering in the last couple of years they
3 have had a much more robust selection of 98%
4 efficient furnaces and we are moving much closer to a
5 20% replacement rate on those styles.

6 MR. FRANCO: Thank you for your comments.

7 MR. BROOKMAN: Yeah, appreciated that.

8 MR. NAYES: You are welcome.

9 MR. ROY: Aniruddh Roy, Goodman. Just a
10 follow up question so even though historically there
11 hasn't been a slight downward trend in the shipments
12 it still is showing an upward curve from 2021 onwards
13 without any factoring of any dip in shipments.

14 MR. FRANCO: Let me go back to the next
15 slide I think it will help explain and it will also
16 deal with part of the AGA's comments in this regard.
17 So let me show this is the projected base case
18 efficiency distributions during the analysis period
19 as again we are starting at 2021 so if you can see
20 from here from the historical data there is a trend.
21 The trend increases more dramatically between 2005
22 say and about 2011. After

1 that there is a decrease. Now between 2011 and 2012
2 is based on Energy Star shipments and we don't --
3 Energy Star doesn't actually have all the shipments
4 so we had to actually scale those shipments up so
5 those numbers might be slightly lower than they are
6 so if AHRI has more accurate data that would be great
7 for those two years but based on Energy Star data our
8 current assumptions in terms of the regional values.

9 We are using the projections between 1992
10 to 2004 which we assume is the period before
11 incentives. We are not using to project in the
12 future the -- we are not using the data between 2005
13 and 2011 because we believe that has a lot of
14 incentives which might not translate into the future
15 and this is the result of that.

16 MR. BROOKMAN: Okay Rick?

17 MR. MURPHY: Rich Murphy, AGA. Just don't
18 understand the logic where this has significant debt
19 from 2012 is it to 2013 and I believe the information
20 that was shared established attributable during a
21 period of time where there were incentives in the
22 market. Is the conclusion that there was no market

1 transformation impact of those incentives during that
2 period of time?

3 MR. BROOKMAN: I see Frank Stanonik has a
4 comment.

5 MR. STANONIK: Well I will let him answer
6 first.

7 MR. FRANCO: Yes there is but there is
8 still -- this is a fairly large lifetime for furnaces
9 to do a full market transformation so there is kind
10 of evolving but it is fairly small in our
11 projections, but at least comment if you think that
12 is accurate.

13 MR. STANONIK: Okay Frank Stanonik, AHRI.
14 You probably think you need to recognize that from
15 2009 to 2012 the data comes from the shipments
16 collected by Energy Star. Okay, so in fact, 2009
17 before 2010 -- so they were collecting the peak and then
18 it looks like the bottom dropped out right so the
19 question I have is in that period in that -- what is
20 it 4-5 year period -- did you check because I don't know
21 myself -- were -- did the Energy Star program always
22 have the same number of furnace manufacturer

1 participants?

2 In other words were you getting the data
3 for those 4 or 5 years from the same group of
4 manufacturers?

5 MR. FRANCO: Thank you for that question
6 and this is a great point. So as I mentioned it had
7 to do some assumptions especially for the data
8 between 2011 and 2012, let me explain. In 2011
9 Energy Star changed their criteria for the North to
10 95% so they don't have any shipments data for
11 instance sold in the North between '90 and '95 and
12 basically their assumptions are just for the 95.

13 They also changed the criteria in terms of
14 a fan efficiency so that dropped a lot of furnaces
15 that were sold as condensing but didn't meet
16 efficiency requirements. In addition to that they
17 also added some constraints in terms of the cabinet
18 losses so that further decreased so actually the
19 value in 2012 that we got the data from Energy Star
20 was only 9% from that and previous data we increased
21 that we believe to I think it was 34% based on what
22 we think the market in the North and everything.

1 We would appreciate more accurate date if
2 it is available.

3 MR. BROOKMAN: Frank keep going.

4 MR. STANONIK: Frank Stanonick, one follow
5 up, two points. So in fact that drop there in a
6 sense may represent a worst case but in fact it is
7 without question incorrect okay. But the other point
8 I want to make and again I'm not going to contest the
9 question about we had this huge peak the years
10 preceding 2011 or so no question some of that was
11 driven by significant tax credits okay.

12 But in terms of this chart okay, so I had
13 let's -- again I'm not going to have the exact
14 number. Let's just say that in the last '08 through
15 '10 or '11 I -- these tax credits introduced an
16 additional I'll just make up a number 5 million
17 condensing furnaces to the market okay. So I'm
18 looking at this chart let's say 2010 so I start to
19 think in 2030 those extra 10 million or whatever
20 number I said furnaces are going to be replaced and I
21 would say that the correct assumption is that once
22 you have got that condensing furnace into that

1 consumer's home that is what they are going to put in
2 again, okay.

3 So even though I would certainly say you
4 can't take that line to say my thing is going to do
5 this I would say in your future projections you have
6 got to account for that blip because that blip will
7 in fact in this case raise the boat a little bit,
8 rising tide raises or something like that.

9 MR. BROOKMAN: Dave Schroeder?

10 MR. FRANCO: I appreciate that comment,
11 thank you.

12 MR. SCHROEDER: Hi, this is Dave Schroeder.
13 So I understand certainly the rationale for pulling
14 out data during that incentive period as being
15 influenced by something outside of the market but it
16 seems like there are some very good reasons to
17 exclude the points immediately after that period as
18 well so if you extrapolated 2005 through or sorry
19 2000 to 2005 out into the future by the time you get
20 to 2021 it's essentially impossible to sell a
21 non-condensing furnace in the northern part of the
22 United States.

1 Any way my point is I don't really
2 understand the rationale for including those two data
3 points that are after the big peak particularly
4 because you have had some inconsistencies it seems
5 like in the source data.

6 MR. FRANCO: Thank you for that so we are
7 in terms of the growth we are just considering 1993
8 to 2004 in terms of the growth and our starting point
9 is 2012.

10 MR. BROOKMAN: Dave Schroeder has a
11 follow-up.

12 MR. SCHROEDER: Another comment and this
13 relates to both this chart and back to discount rates
14 and forward to discount rates actually. So you could
15 count every house you analyze, you calculate an LCC
16 savings done before correct. So from that that
17 actually implies also a discount rate that consumers
18 would tolerate and that number is going to be
19 significantly different possibly than the discount
20 rates you assigned in the previous maybe two slides
21 ago and I think you are about to tell us that you
22 used the payback period of 3 years for switching

1 options which applies another discount rate so you
2 actually have homes, one individual home with three
3 different discount rates what it look like.

4 MR. FRANCO: I believe there is only 2,
5 there's the 1 to bring back to the present value and
6 then we will discuss the fuel switching I didn't
7 understand the third.

8 MR. SCHROEDER: So payback period or
9 payback periods that consumers would tolerate and
10 aren't inherently related to discount rate you have
11 assigned discount rates a few slides ago. The LCC
12 numbers in combination with these shipment numbers
13 imply a second discount rate, right because you have
14 got a payback period from the LCC analysis and then
15 in switching you have a 3 year payback period so
16 that implies a different discount rate. So one home
17 is 3 discount rates.

18 MR. FRANCO: Please submit your comments.

19 MR. BROOKMAN: Dave? Neil are you in the
20 same contents stream?

21 MR. LESLIE: I am in the draft in this
22 part of it.

1 MR. WINNINGHAM: Neil could I just
2 interject one note on Dave's comment as a follow on?

3 MR. LESLIE: Mine is a clarification more
4 than anything else. I am very confused as to what
5 is AHRI data and what purported over to the EPA data
6 on that chart. There's a 2013 data point diamond
7 shaped and you are saying to 2012 I don't know where
8 the 2013 data wound up coming from and I don't know
9 whether the 2009 data point is from AHRI data or it
10 is from the EPA data so I would just like to
11 understand the source of the specific data points on
12 that chart, that would be very helpful to me.

13 MR. FRANCO: Thank you so much, let me
14 clarify again. Data before 2009 was provided from
15 AHRI in terms of the fraction of condensing and
16 non-condensing and that was actually provided by
17 region. After 2009 --

18 MR. LESLIE: Wait on 2009? For the 2009
19 data plan it shifted, so up through 2008 is AHRI
20 data? I just want to make sure.

21 MR. FRANCO: Up through 2009, 2009 so
22 that's the relation to the previous rulemaking AHRI

1 provided data up to 2009.

2 MR. LESLIE: Up through 2009?

3 MR. FRANCO: Yes.

4 MR. LESLIE: Not up through 2008? So
5 2009, 2010, 2011, 2012 and 2013 then become a shift
6 in data sources to the EPA data source. I just want
7 to make sure that I have that.

8 MR. FRANCO: Let me clarify 2013 is a
9 projection number. 2012 is the last number that we
10 got from Energy Star, I'm sorry if I misspoke.

11 MR. BROOKMAN: Dave, thanks for being
12 patient.

13 MR. WINNINGTON: Yes just to kind of
14 follow on to Frank's thoughts -- and I believe it was
15 the 2010-2011 timeframe -- EPA made a significant change
16 to their program that put a lot more burden of
17 testing as well as product use supplied so there may
18 have been some influence here that people just
19 dropped out and didn't report.

20 MR. FRANCO: Thank you for that, I did
21 mention that about the 2011-2012 values that's why we
22 needed to adjust them because of that.

1 MR. CYMBALSKY: This is John from DOE so
2 we have manufacturers and others in the room, are
3 there data that exists that we can get provided to
4 us? I mean I know the data exists so --

5 MR. KREBS: That's what Neil was trying to
6 ask but you know he's not really educated.

7 MR. CYMBALSKY: He's more polite than me.

8 MR. DELASKI: I would just comment, this
9 is Andrew. The AHRI data is wonderful data and it
10 will be wonderful to have it up to date. I would
11 just encourage the industry to manufacturers, the
12 associations to submit up to date data and that would
13 really help the analysis undoubtedly. In the absence
14 of updated data, the Department has to do the best
15 they can with what is provided in the public realm so
16 I would encourage I see Dave nodding, I would
17 encourage all the manufacturers who are here to work
18 for the good of the Association to provide up to date
19 data.

20 MR. BROOKMAN: I believe Harvey is next.

21 MR. SACHS: Harvey Sachs and Dave
22 Schroeder I think about my own life. I think that

1 the switching thing is entitled to a different call
2 it payback it is a virtual number that is a proxy for
3 our uncertainties about the stickiness in consumer
4 behavior. I have done something very
5 non-cost-effective the last several years in keeping
6 my cable connection so the stickiness may well have a
7 different value than the capital investment decisions
8 and I would defend DOE for trying to develop a proxy
9 which I am darn sure is not perfect.

10 MR. BROOKMAN: Mark Krebs, I mean, pardon
11 ,
12 me.

13 MR. KREBS: Close enough, we are among
14 friends. Einstein is credited with saying you know
15 solutions to problems should be as simple as possible
16 but no simpler okay and that's kind of where we are
17 at I think. You know I am looking -- I see all this
18 stuff and part of it is from this data base, part of
19 it is from another data base, you know I realize that
20 those big rebates for high efficiency furnaces
21 impacted this stuff, I realized that the crash, the
22 great recession whatever they called it had an impact

1 on shipments but why don't we just get the raw AHRI
2 shipment data for this period, for the period that we
3 know of and then we can deal with it.

4 Then we have something to talk about and
5 we are not you know, it is not all piece-milled
6 apparently like it is now.

7 MR. BROOKMAN: Well we have heard an
8 additional treaty for the data to come forward
9 somehow.

10 MR. KREBS: It's just another way of
11 reiterating what Neil tried to say.

12 MR. BROOKMAN: So now we are moving on
13 there, keep going.

14 MR. FRANCO: So this is a major piece of
15 the analysis there's quite a few slides to go through
16 in this analysis.

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1 MR. BROOKMAN: Okay let's start back up.
2 I understand here at the outset Victor has
3 clarification.

4 MR. FRANCO: Thank you yes there was a
5 question from N.J. in regard to the base case
6 efficiency distribution. Application in the LCC
7 spreadsheet and there was a spreadsheet there it is
8 disaggregated by 30 RECS, designated regions.
9 Actually RECS provides 27 to be more accurate. We
10 disaggregated an additional three, one of them is
11 West Virginia because the North has West Virginia
12 disaggregated so that is separately.

13 In the actual spreadsheet we list West
14 Virginia as part of another region but that was just
15 a misprint, West Virginia is a separate region.

16 MR. BROOKMAN: So I just got the word from
17 Brenda that we need to leave this room at 5:00 sharp
18 so I want to encourage everyone's commenting to try
19 to keep their comments especially succinct so we can
20 make it through all of this material and so now back
21 to Victor.

22 MR. FRANCO: So there are a number of

1 questions related to this part of the analysis and I
2 will try to answer as many of the preliminary
3 questions as possible and your questions as clearly
4 as I can. I will focus on three slides mostly and I
5 will go through the other slides fairly quickly.

6 So kind of the setup of the analysis is
7 that we did do product switching for this equipment.
8 In the analysis we assumed that --

9 MR. BROOKMAN: Thanks you, guys. Keep going
10 Victor.

11 MR. FRANCO: In the analysis, we assumed
12 that there is potential for switching when going from
13 the current standard to the 90 or above standard
14 levels. In that case, we would be going from
15 potentially from non-condensing situation replacement
16 situation we are going to condensing weatherized gas
17 furnaces is one of the options, the primary option.

18 And alternative options are electric
19 furnace and heat pump in terms of the electric
20 heating. In terms of cooling because of the
21 associated cooling and heating equipment you
22 potentially -- if you have a central air conditioner

1 you potentially could go to a central air conditioner
2 or you could go to an air handler plus a heat pump.

3 In terms of water heating, there is also
4 the potential for switching if you have an orphan
5 water heater we also analyze the potential for going
6 from a gas storage water heater to an electric
7 storage water heater.

8 MR. BROOKMAN: Yes Steve Rosenstock?

9 MR. ROSENSTOCK: Steve Rosenstock, Edison
10 Electric Institute. As much as I would love to think
11 that the electric options were the only options that
12 is not true. I will try to be as brief as possible
13 for what Doug said. In my view, looking at this and
14 looking at the support document this is an incomplete
15 analysis.

16 There are other options that consumers can
17 choose from for example, oil fire non-condensing
18 furnaces, other alternative direct heating equipment,
19 room by room heating equipment, biomass, wood type of
20 heating system if they really wanted to spend a lot
21 of money.

22 In terms of the water heating system

1 there's oil fired water heaters, there are solar
2 water heaters, there are instantaneous water heaters.
3 This is a very limited analysis assuming that
4 consumers only have basically one option or two
5 options at most and just simply is not true.

6 Therefore a lot of the numbers it is
7 really incomplete because it is assuming that
8 consumers will look at no other technology whatever
9 in terms of any sort of other -- all the impacts that
10 they only have a choice of these two and there is
11 nothing else out there and well there's other -- all
12 the other associated side effects. So most of this
13 section, anything on fuel switching in my mind this
14 is a totally incomplete analysis and all the results,
15 assumptions and results are erroneous thank you.

16 MR. BROOKMAN: Dave Winningham?

17 MR. WINNINGHAM: This is Dave Winningham
18 with Allied Air. Very quickly and it may not fit
19 here but is there an extended repair versus replace
20 of product considered in this methodology?

21 MR. FRANCO: Could you clarify what you
22 mean by extended?

1 MR. WINNINGHAM: People would choose to
2 repair their old inefficient product so to speak,
3 replacing heat exchanger versus incur the cost of a
4 new more efficient product.

5 MR. FRANCO: Thank you for that
6 clarification. In this analysis we did not model an
7 extended repair as an option, please provide that in
8 your comment if you believe that that should be
9 added, thank you so much for that comment.

10 MR. BROOKMAN: Okay.

11 MR. FRANCO: The next two bullet points
12 are related to slides that would be more specific so
13 I won't go into those until we get to those two
14 specific slides.

15 MR. CYMBALSKY: I just want to point out I
16 think on this slide we tried to set up answers for
17 priority question C and question 4 in the related to
18 switching logic.

19 MR. FRANCO: In relation to that actually
20 I forgot to answer one of the questions. One of the
21 questions was if we modeled going from switching from
22 a non-condensing to a non-condensing in the base case

1 in the LCC analysis and we did not model that.

2 We believe that for various reasons some
3 consumers in the base case decide to remain even
4 though it might not be the best option in going from
5 non-condensing to non-condensing so that answers one
6 of those questions.

7 The next few slides are basically just the
8 options, so I will just go really, really quickly
9 through these. As you can see these are the same
10 that we have described earlier just in graphically.
11 This further disaggregates how we use the analysis.
12 We consider whether there is commonly venting or not.
13 This is fairly complicated, it's -- I believe it is
14 fairly well explained in the appendix related to fuel
15 switching and please provide any comment.

16 MR. ROSENSTOCK: Steve Rosenstock, EEI.
17 Then I will ask it a different way, why didn't you
18 consider other options that are out there for
19 consumers?

20 MR. FRANCO: At the time we collected the
21 analysis these seemed to be the options that were --
22 that most that would potentially be the ones that

1 consumers would go to the most. Please submit
2 comments if you think that we should consider others.

3 MR. ROSENSTOCK: Steve Rosenstock, EEI.
4 What's that based on?

5 MR. CYMBALSKY: This is John from DOE. So
6 in your remarks before you mentioned that at least
7 for a couple of technologies that were the I'm using
8 your words, "very expensive options" so if the idea
9 of fuel switching is that you are doing it to save
10 money which the economic rationale would present here
11 I guess my question is why would you switch to "very
12 expensive option" relative to this and include that
13 as a viable consumer option.

14 MR. ROSENSTOCK: Steve Rosenstock, EEI.
15 In certain cases that very expensive option might be
16 the same price or lower price than what you might
17 have to do inside the house based on your
18 configuration of the current system. So for some
19 consumers it might be a more expensive option but for
20 others based on what they might have to do to meet
21 the new standard it might be the same or a lower
22 price so again it is all relative to what a consumer

1 is facing with its current system.

2 MR. CYMBALSKY: Okay, in that case, we will
3 ask you to provide the data on the cost of switching
4 to oil including the environmental and tank issues
5 that exist with that and then if you have any data on
6 switching to wood from gas -- and then you mentioned, I
7 think, direct heating equipment -- that's fine, we will
8 take the data that you have on that.

9 MR. ROSENSTOCK: Steve Rosenstock, EEI.
10 Again, thank you for that but again I was just saying
11 there's so many options out there and it just seemed
12 like you were just totally you know not considering
13 all -- I'll stop there thank you.

14 MR. BROOKMAN: Okay thank you Mark Krebs?

15 MR. KREBS: I won't stop there I have got
16 a couple more to add to Steve's list. One of them is
17 if you are really poor and you can't afford to
18 replace your furnace that you just turn on the range
19 and try to heat your house that way. You know,
20 another option is if you go down to the dollar store
21 or somewhere you know and you get an electric
22 resistance heater, you know maybe you get a whole

1 bunch of them and plug those in because that's the
2 only choice you have got, either that or freezing to
3 death.

4 So there are other options and yeah they
5 should be considered.

6 MR. BROOKMAN: Okay let's proceed with the
7 analysis that is here.

8 MR. FRANCO: Thank you for all of those
9 comments, please provide written comment. These are
10 the options in the graphical the next presents the
11 same in a tabulated format. As you can see there's
12 six combinations that we start with there are
13 non-condensing with certain other combination
14 air-conditioning or water heating combinations.

15 This next slide presents the actual
16 tabulated numbers in terms of how many households
17 belong to these criteria, the most common is a
18 non-weatherized gas furnace with a gas water heater
19 and a central air conditioner which represents about
20 66% of the sample.

21 I'll stop on this one and be more detailed
22 because this is one of the one's we receive a lot of

1 comments on and please provide --

2 MR. BROOKMAN: We have a comment from Mark
3 Naves on line who says a question in fact, does this
4 switching take into account the complete inability to
5 install a condensing gas furnace in place of a
6 non-condensing gas furnace and are required to
7 install a different form of heat?

8 MR. FRANCO: Thank you for that question.
9 Would you repeat that --

10 MR. BROOKMAN: Steve Rosenstock?

11 MR. ROSENSTOCK: Yeah again it might be in
12 the weeds here I was trying to see -- as part of this
13 decision making matrix I am just wondering especially
14 on the water heater side was there any factor
15 considered for age of the water heater versus the
16 furnace for example if albeit an equation if the age
17 of the water heater is less than half the age of the
18 furnace are people really going to make that switch
19 or less than one third?

20 I mean you are an excellent salesperson,
21 you convince someone to take out a 5 year old gas
22 water heater when they are replacing a 20 year old

1 furnace.

2 MR. FRANCO: Thank you for that comment,
3 yeah that is described in our TSD we do take that
4 into account. We assume that for example the furnace
5 is fairly old it is more likely that they will
6 replace it. If it has just been replaced only a few
7 years then it is less likely, the description is in
8 the TSD. Question?

9 MR. BROOKMAN: Yes please?

10 MR. MURPHY: Doug and John, could you
11 direct us to where we could find more information on
12 where those situations where that previous question --
13 about where it is impossible to install a condensing
14 is included in the fuel switching?

15 MR. FRANCO: Okay yes let me -- this was
16 related to installation costs. Before, I mentioned that
17 what we do in our analysis is we assign very large
18 costs for some of these households with assigned,
19 sometimes it's a very, very large cost because you
20 are going to have multiple laws in a very large
21 ventilation.

22 MR. MURPHY: I'm sorry this is Rich

1 Murphy, AGA. I think the question I'm not sure but
2 for instance if there is a condominium project where
3 they do not allow penetrating an outside wall, how is
4 that considered in the analysis?

5 MR. FRANCO: We do have it different for
6 example for multi-family kind of condominium
7 situations and situations sometimes referred to as
8 row houses. We do account for them having to
9 penetrate multiple walls, the cost is usually
10 significant that usually that requires some analysis
11 or it is a significant cost that's associated to
12 that.

13 MR. BROOKMAN: Harvey Sachs?

14 MR. SACHS: Harvey Sachs. Since this has
15 come up several times for the use of generally fairly
16 low rise buildings we are seeing the introduction
17 into the market of who the stack solutions for
18 venting condensing furnaces vertically rather than
19 horizontally.

20 MR. FRANCO: Thank you for that comment.
21 So I am going back to the fuel switching so this is
22 how we conducted fuel switching it is based on

1 economics in terms of the household so as described
2 before there is a payback associated with this
3 analysis. We do this analysis household by household
4 as described before some households have very
5 different installation costs total install costs and
6 very different operating costs because how a
7 different region of the country where natural gas or
8 electricity prices are very different from other
9 households so all of that is taken into account what
10 we are doing if you follow this flow chart.

11 After that we do a payback calculation
12 related to the -- comparing the non-weatherized gas
13 furnace option of the 90% or above versus the
14 electric furnace or heat pump options. If the
15 payback period with that comparison is above 3.5
16 years we assume that a homeowner would choose to
17 switch. If the payback is less than that then we
18 assume that the homeowner will remain with
19 non-weatherized gas furnace.

20 This payback criteria is based on this
21 analysis data and RECS 2009 data. We will go
22 through the explanation of how that is calculated.

1 We had a question again about this analysis data
2 which is this American Home Comfort survey about the
3 availability of the data.

4 We don't for many of these have the
5 disaggregated data by either different housing
6 incomes, the raw data but we do have a little bit of
7 sense of the distribution by region in terms of that
8 would give some results. The data that we actually
9 did use from that are these aggregated values and we
10 provide those here in this table and they are
11 available in the TSD.

12 We do not use any other data that is
13 provided from this survey, only the data that is
14 reported here.

15 MR. BROOKMAN: Dave Schroeder?

16 MR. SCHROEDER: This is Dave Schroeder.

17 Did you ask decision analysis if this aggregated
18 distribution level data was available?

19 MR. FRANCO: Yes they do have this
20 aggregated data. It might not be all different
21 factors that you might want to consider but I'll go
22 through the payback you have to match that to what is

1 available from RECS so that's what's the complexity
2 in terms of matching that data to the RECS data.

3 It's about choosing to match the
4 aggregated data as shown.

5 MR. BROOKMAN: Steve?

6 MR. ROSENSTOCK: Steve Rosenstock, EEI.
7 Again I'm looking at this diagram. Shouldn't it say
8 that the payback is less than 3 years if they are
9 going to switch or are they more than 3 years?

10 MR. FRANCO: I'll go into that. It's a
11 little bit counter-intuitive and I'll go into why
12 that is as we go, thank you sorry.

13 MR. MCCRUDDEN: Charlie McCrudden, ACCA.
14 Way back on slide 29 sort of at the beginning you had
15 a payback period life-cycle cost in yellow right here.
16 This one has payback period of a 3.5 years, that's
17 some kind of determination. How did you come up with
18 3 years and is that a payback period that DOE looks
19 at or is it just --

20 MR. FRANCO: I'll go through in more
21 detail about the actual calculation what that means
22 and hopefully that will explain your question, thank

1 you.

2 MR. MCCRUDDEN: Okay.

3 MR. FRANCO: So the decision analysis or
4 home comfort survey data is provided here on this
5 table on the -- on your right so essentially the
6 nominal values are what they represent is the answer

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10 to this question. The question is what are consumers
11 willing to pay for 25% higher efficiency equipment so
12 this could be, this is HVAC equipment so this is the
13 central AC gas furnaces, any of that type of
14 equipment.

15 Responses, obviously there is a
16 distribution -- in terms of the responses this is the
17 aggregate value that they are willing to spend
18 compared to not having this 25% efficiency. We use
19 as much data as available, these are all the surveys
20 that are available from 2006 to 2013 and we convert
21 that to 2013 dollars.

22 Next we compare that to what's the average

1 cost that people pay in terms of energy costs, in
2 terms of central air conditioning and heating in
3 RECS 2001, 2005 and 2009 that matches this period as
4 well.

5 We convert that from nominal dollars to
6 2013 dollars and we get this 906. The equation to
7 calculate the 3.5 year payback is provided here below
8 and this results says you can see it is 792 which is
9 what consumers are willing to pay for 25% higher
10 efficiency, 25% of that value in terms of energy
11 costs and you get a 3.5 year payback so that is the
12 basis for the 3.5 year payback.

13 That's how much they are willing to pay to
14 go to higher efficiency non-weatherized gas furnace.
15 In the analysis I know there's a question, in the
16 analysis therefore we assume that if the payback is
17 higher than that there will be switching so that is
18 why the payback here is greater than 3.5 it is when
19 they are switching.

20 If it's less than 3.5 there is no
21 switching so hopefully that clarifies that question.
22 When you bring two additional conditions then to this

1 to finalize our analysis. The first condition is
2 that the total installed costs of the alternative
3 needs to be less than the non-weatherized gas furnace
4 installation cost. So if that isn't the case there's
5 no switching so that's our first condition. So this
6 alternative has the total installed cost has to be
7 less than that.

8 The other condition is that if the payback
9 is below zero meaning that the alternative actually
10 has greater savings in terms of energy costs, there
11 is also switching. This is the case for example if
12 you are in an area with low electricity rates
13 compared to natural gas and then potentially your
14 heat pump will be more cost -- there will be more
15 cost savings from the heat pump option.

16 This describes this and I know there are a
17 number of questions so I will stop here and answer
18 your questions.

19 MR. BROOKMAN: Mark?

20 MR. KREBS: Yeah in the opening page or so
21 of the official federal registered NOPR you know it
22 shows a simple payback of 7.2 years you know along

1 with an average life-cycle savings of this \$305.00.
2 You know I'm just suggesting maybe in league with
3 Einstein's definition of doing things as simple as
4 possible would DOE consider just straight going to a
5 payback criteria? You know I mean and if something
6 is better than a 3 year payback, you know I for one
7 I'm not going to contest it, I am going to consider
8 that in my customer's best interest and stay away
9 from DOE you know.

10 Is that a possibility to consider you know
11 that we go to something totally different than this
12 life-cycle costing thousands of pages of complexity
13 you know, can we do that?

14 MR. BROOKMAN: Thank for the comment Mark.

15 MR. KREBS: No, I appreciate you know is it
16 doable is it within -- is it even within -- I mean as
17 the secretary determines with that language, isn't it
18 within your capability of doing this or are you
19 prohibited from doing it?

20 MR. COHEN: This is Dan Cohen from the
21 General Counsel's office. There is an authority
22 within EPCA that allows us to do it -- essentially

1 what you are saying is a three year simple payback?

2 MR. KREBS: Well I know there is a
3 rebuttable -- I know that and here's 3 1/2. In the
4 spirit of compromise I am willing to go to 3 years.

5 MR. COHEN: But just to be clear that
6 already kind of goes around the other 7 factors in
7 the statute right, it's just a simple determination
8 honestly your payback.

9 MR. KREBS: I'm just -- you have the
10 flexibility to do it if you want, that's what I am
11 hearing unless you tell me different.

12 MR. BROOKMAN: Frank Stanonik?

13 MR. STANONIK: Just an observation, I mean,
14 I guess I'm sitting it is probably irrelevant, but I
15 am scratching my head saying okay you posed the
16 question or you presented this as willing to pay for
17 a 25% higher efficiency okay. Well if you go -- if
18 your baseline is 80% AFUE and you go to 92 that's 12
19 point gain over 80, that's a 15% increase in
20 efficiency so I am trying to think, okay, so why this
21 particular question when in fact the situation we are
22 analyzing or trying to analyze is much closer to what

1 would the consumer be willing to pay for a in my
2 example of a 15% increase in efficiency?

3 This just strikes me as odd.

4 MR. FRANCO: Thank you very much for that
5 comment. Just a reminder we did not design this
6 question and this is just a question that was
7 designed not on our intent and this is what they
8 asked in terms of the 25%. There isn't a survey that
9 would go into that detail. There are other surveys
10 that provide -- sometimes you ask people if maybe the
11 energy cost is less than that. Usually, the payback
12 if it is a little bit less they are thinking that
13 they need to pay usually greater.

14 So this might be conservative, potentially
15 in that sense looking at other surveys, but this is
16 the survey data that we have and we feel that we have
17 found that it has the most data. Please provide a
18 comment in that regard to --

19 MR. STANONIK: I'll provide a comment now,
20 I mean I don't envy the task that DOE has okay and we
21 have certainly gone back and forth about how you
22 would like to have the best data you could get and

1 some of that might be in our hands and some of that
2 we can share and some we can't or whatever, but my
3 comment is, okay, so in some cases if you don't have
4 good data then I don't necessarily agree that in all
5 cases then you grab whatever might be there because,
6 say in this case, this is the question they asked and
7 I would say but this question really doesn't have
8 relevance to this rulemaking and so I think in some
9 cases my comment would be sometimes then don't use
10 whatever is the available data because it just
11 doesn't fit.

12 Don't pound a square peg into a round
13 hole.

14 MR. CYMBALSKY: This is John from DOE. So I
15 disagree with the foundation of your statement that
16 this doesn't apply. This is actually just saying
17 what the willingness to pay for efficiency is. If it
18 says 10, 5, 15, it gives a number right, it's
19 normalized so it's perfectly reasonable.

20 MR. STANONIK: I was asked to give a
21 comment so I was. And by the way I wasn't good
22 enough to -- I wasn't staying for that comment

1 either.

2 MR. CYMBALSKY: Thank you for that
3 comment, we only thank you for good comments.

4 MR. BROOKMAN: Dave Schroeder?

5 MR. SCHROEDER: That's a difficult
6 question to follow but I am curious why in all of the
7 rest of the LCC's spreadsheet and the NOPR the word
8 payback means what I believe to be the traditional
9 definition of payback, meaning the time after which
10 you start to recover money and in this case if you
11 follow the logic in the LCC spreadsheet that is not
12 what payback means.

13 Payback in this case means the time after
14 which consumers begin to lose money to operational
15 cost increases relative to the baselines, so could you
16 comment on why you mixed those terms? I mean, even
17 within this one spreadsheet they are mixed.

18 MR. FRANCO: Thank you for that comment.
19 I appreciate that, we will try to define that better
20 and I can see that could be misunderstood because
21 they are using the same term we will correct that,
22 thank you.

1 MR. CYMBALSKY: So on this slide, Dave
2 just pointed to the questions we think we have
3 addressed. So we think priority questions B and D and
4 questions 1, 2, 3, 5, 6 and 7 in the related to fuel
5 switching have been addressed so if not, please --

6 MR. BROOKMAN: Dave Schroeder?

7 MR. SCHROEDER: This is Dave Schroeder I
8 think --

9 MR. CYMBALSKY: I think we are going to
10 get to C eventually.

11 MR. FRANCO: Yeah let me know if I don't
12 get to it in my next slide. This I think has a
13 couple of responses. This provides -- this is the next
14 slide to kind of go over a little bit about detail,
15 not too much due to the time constraints, but this presents
16 the summary of all the inputs. There are more
17 details in the TSD compared to what is shown here.
18 This gives you the -- how we determine the cost for the
19 electric furnace, central AC and heat pumps, the
20 price trends of these two, all the installation and
21 maintenance costs that we assume when we got that
22 information in terms of the value in terms of the

1 energy use, we are using the latest energy efficiency
2 standards that would be applicable during that period
3 of time 12/21 and also the lifetimes.

4 As you can see, most of the data comes from
5 previous rulemakings that DOE has conducted for this
6 product. There were a couple of questions in
7 relation to these, which I will go through in more
8 detail, that are related to first electric furnaces.
9 For electric furnaces we didn't have direct data
10 similar to what we do in terms of the manufacturer
11 cost.

12 We have a value that comes from RS Means
13 and there was a question why we multiply that times
14 3. We assume that the markup for that equipment
15 would be around 3 and so we divide the RS Means value
16 by 3 to get the manufacturer, the manufacturer
17 production cost.

18 After we get that value then we use our
19 general markup distribution to that value, that
20 single value to become comparable to the other
21 values, so that is the answer to the first question.
22 There was another question related to the electric

1 water heaters in terms of the differences between
2 natural gas water heaters and electric water heaters.
3 Usually the market, if you are purchasing between
4 electric water use and gas water heaters, electric
5 water heaters are usually cheaper in terms of the
6 manufacturer costs.

7 Here though, we are considering the case
8 where we are having to switch from natural gas to
9 electric water heaters so we have to include the fact
10 that the major cost is due to the fact that we have
11 to do installation costs in terms of potentially
12 adding electric outlet, potentially doing some work
13 in terms of the electrical panel, and those costs are
14 added in.

15 In addition to that, when you are going
16 from natural gas to an electric water heater you
17 might have to size that a little bit to a larger
18 size. For example, if you start with a 60 gallon gas
19 water heater you might have to go to a 50 gallon
20 water heater because you want to get the same output
21 out of it, say to take your showers.

22 So an electric water heater would be 50

1 gallons, natural gas would be 40 gallons. We take
2 that in counter analysis as well. The details are
3 provided in the TSD. Please submit anything that you
4 feel that needs some further clarification.

5 MR. CYMBOLSKY: So I think on this one for
6 the docketed questions we think we have 3, 6 and 7
7 from the questions asked previously and not answered
8 by DOE.

9 MR. FRANCO: Do we have any questions?

10 MR. CYMBOLSKY: If we didn't, please ask
11 it.

12 MR. BROOKMAN: Neil go ahead.

13 MR. LESLIE: This is Neil Leslie, GTI.
14 Maybe you did, so the simple question I guess, why was
15 the uniform distribution chosen for remaining
16 lifetimes for cooling and water heating equipment?

17 MR. FRANCO: Yes, thank you for that.
18 That question actually relates back to how we account
19 for the remaining lifetime of the water heater.
20 There is no data in terms of when the furnace fails --
21 what's the age of the water heater -- so we assume kind
22 of a uniform distribution -- we assume, well it's between

1 1 and 13 years once the furnace fails.

2 If you feel that maybe something else
3 could be better to represent that please let us know.

4 Thank you, so now this is the final slide
5 for product switching in terms of the result -- so these
6 are the results of the switching and as you can see
7 here they vary between North of the country and
8 between the national standard levels. So as you go
9 to a higher efficiency standard levels the switching
10 goes up, which follows what you might think.

11 You also get switching to electric
12 furnaces and heat pumps that are disaggregated in
13 these figures. All the way at the bottom there is
14 also the switching that occurs between the gas
15 storage water heater and the electric storage water
16 heater and those values are there.

17 MR. BROOKMAN: Don Brundage?

18 MR. BRUNDAGE: Don Brundage, Southern
19 Company. I think your numbers on switching to
20 electric furnace are unrealistically high. Even in
21 the South, meaning rest of the country, it is rare at
22 my company to have a destroyed electric furnace.

1 They have actually been banned in single family
2 housing under the building code for about 10 or 12
3 years. What is especially puzzling is the percentage
4 numbers looking at these between electric furnace and
5 heat pump, it appears to be about the same percentage
6 in the North picking electric furnace over heat pump
7 compared to and rest of country and with the higher
8 heating loads that would seem to be very counter
9 intuitive.

10 I would expect lower numbers choosing --
11 much lower numbers choosing electric furnace over
12 heat pump in the South and very minimal choosing
13 electric furnace over heat pump in the North, thank
14 you.

15 MR. FRANCO: Thank you so much for those
16 comments. Let me just go through two additional
17 things that might help on this. We did assume in the
18 energy use the efficiency of the heat pump to vary
19 between regions. In the North, even though the sea
20 level is the same in the North, efficiency drops
21 because of the climate conditions.

22 In the South the efficiency would be

1 greater so that it counts for some of the numbers how
2 they play out. Also you need to consider that these
3 numbers are aggregate for the North. There are some
4 situations in the North where electricity prices are
5 fairly competitive with natural gas.

6 One such situation is in the Pacific
7 Northwest, so those are considered if you look at the
8 actual disaggregated numbers by region. For example, in
9 the North you would see that as well.

10 MR. BROOKMAN: Rick Murphy?

11 MR. MURPHY: It's Rick Murphy, AGA.

12 Victor this chart here do you also have that broken
13 up between replacement and new construction?

14 MR. FRANCO: This between replacement and
15 construction, yes. I think it is in the appendix D -- if
16 not, it would be D and I but I think it is in the
17 appendix and broken down as one of the actually,
18 that's one of the major inputs to the NIA analysis,
19 we put it down by new construction and replacement
20 part.

21 MR. KREBS: Victor Mark Krebs again with
22 Laclede. In this chart especially are we looking at

1 -- we are looking at replacements and clearly it says
2 so right there, you know what about new construction
3 because I think fuel switching is a really different
4 scenario in new construction because they don't have
5 all of these, they don't have to do a lot of work
6 upgrading their electric service panel, you know.

7 They just simply go with the next bigger
8 size you know, they -- by your own calculations I
9 think you show a savings in construction costs by not
10 having to build a constructive flue so you know I
11 think that the switch might be total, you know is my
12 point. Heat pumps with electric resistance or heat
13 pump water heaters perhaps you know and everything
14 else you know there will be no gas service in which
15 case what are the environmental impacts of that.

16 I guess you know raise that as areas that
17 you know it is kind of hard to determine how you are
18 separating this out you know in all cases. Let me
19 just ask you flat out -- you know is there a set
20 percentage of the market that you -- that's new
21 construction in your papers that I have been talking
22 about all day -- you -- say you assumed 25% you know, is

1 that similar here?

2 MR. FRANCO: That's correct, so just to
3 reiterate this is the household by household. The
4 building sample 25% is assigned to new construction.
5 That's then you can disaggregate those results and
6 sorry about that that's a good clarification. These
7 results are only for replacements. There's a similar
8 table in the TSC and I'll point to the page that has
9 the new construction results and all the analysis,
10 new construction is obviously very different, very
11 different considerations.

12 The page for this is page 22 and 23. On
13 page 22 this table is 8J43, which is the residential
14 results and 8J.4 is the new construction results,
15 sorry about the clarification.

16 MR. BROOKMAN: Harvey Sachs?

17 MR. SACHS: First I want to thank Mark
18 Krebs. I am agreeing with essentially everything he
19 said that new construction is battleground and that
20 leads me to the question for Victor. In your
21 consideration heat pump case were you considering the
22 sort of classic all American air source heat pump or

1 were you considering some of the newer BRF equipment?

2 MR. FRANCO: This is just the regular
3 source of heat pumps.

4 MR. SACHS: So we are certainly seeing the
5 beginnings of substantial market transformation in a
6 couple of northern areas where they are finding
7 capacity maintenance with variable speed compressors
8 down to speeds below zero and seeing relatively high
9 HSPF values or better yet COP values under these
10 conditions.

11 This may emerge as something that matters
12 competitively far more than the question of
13 condensing versus non-condensing.

14 MR. BROOKMAN: Dave Schroeder then to
15 Steve.

16 MR. SCHROEDER: I think you may have tried
17 to answer this question before but I am not sure that
18 I fully understood your answer so I am going to try
19 again.

20 MR. FRANCO: Thank you.

21 MR. SCHROEDER: In cases where there is a
22 first cost advantage of the switching option relative

1 to the 92% case the model chooses that option where
2 you have essentially a negative payback as you have
3 defined it.

4 MR. FRANCO: Let me try to rephrase that.
5 So we compare the non-weatherized gas furnace you
6 mentioned 92% versus the electric option. If the
7 payback is below 3.5 then that -- there's no
8 switching. If it goes negative that, so below zero --
9 then there is switching because that's the case when
10 you actually have operating cost savings on the
11 electrical side.

12 MR. SCHROEDER: Okay so if you have
13 operational cost savings and you have first class
14 savings, even relative to an 80% furnace it would
15 select that case as well and it would consider it to
16 be a fuel switching case. You would also have
17 probably a good life-cycle cost savings but I don't
18 understand how that it related to the rule?

19 Do you understand my question?

20 MR. FRANCO: Yeah, this is what I
21 mentioned earlier -- we didn't consider the case
22 where you are going from a non-condensing to these

1 other options. If you think that we should consider
2 that's please submit a comment on that -- yeah.

3 MR. BROOKMAN: Steve Rosenstock?

4 MR. ROSENSTOCK: Steve Rosenstock, Edison
5 Electric Institute. Again another option which is
6 not considered is the ground source heat pumps which
7 Harvey was very involved with for many, many years.
8 Geo-thermal heat pumps is another design option for
9 new construction. Anyhow I am looking at all of
10 these numbers and I am just -- it's basically from
11 what I am seeing in terms of when you switch over the
12 water heaters is that it seems that it is 20% or
13 switching to electric heating source that another
14 that 2 up to 4% of that, 20% or up to 35%, basically
15 about 20% of those are also -- they are also going to
16 switch their water heaters as well.

17 And again I guess you took a lot of things
18 into account, I just you know especially for over 55
19 gallons we are going to have to go to a heat pump
20 water heater, I definitely have to agree with Don
21 Brundage of the Southern Company. I think especially
22 for replacements in my mind I think with all the

1 other technology options out there these numbers just
2 seem way, way high and also there is no context of
3 the fact that the heat pumps have increased twice in
4 efficiency and their costs have increased twice over
5 the last 9 years and this doesn't talk about the
6 other side of the equation where people can put in
7 gas equipment rather than heat pumps because of the
8 higher cost of the heat pumps, thank you.

9 MR. BROOKMAN: Frank Stanonik?

10 MR. STANONIK: I think there is one area
11 in this analysis that you need to factor in so you --
12 in the chart on slide 74 on a national basis roughly
13 20% of replacement installations are installations
14 where there is no air conditioning.

15 MR. FRANCO: Thank you, that's correct.

16 MR. STANONIK: So when this consumer is
17 faced with the choice of replacing their gas furnace
18 and they are presented with the choice that it is
19 only going to be a condensing gas furnace okay.
20 Given that significant purchase and significant
21 change out of the system okay, I think you need to
22 consider that if you know, if they aren't into this

1 situation well what am I going to do and the choice
2 is well we can give you this very expensive high cost
3 installation condensing gas furnace or we can give
4 you a heat pump, which oh by the way will give you
5 air conditioning that you didn't have in the past and
6 as Andrew and I discussed, consumers value comfort and
7 in fact there is a dollar value to that comfort, okay.

8 If you think about that, that
9 significantly changes at what point the consumer
10 would say from an economic standpoint, oh sure, give
11 me, let's forget that old gas product just give me
12 that wonderful heat pump I will have heated and I
13 will have cool and that will be great because they
14 didn't have cool and there's no question that a
15 standard home in the United States today has heating
16 and cooling and those people who don't have it either
17 can't afford it for whatever reason or they just
18 haven't got around to it but they sure would like to
19 have it and so I think you have to factor that in.

20 That the choice might be okay you are
21 either going to have to pay this cost for your new
22 gas furnace or whatever or I could give you this heat

1 pump and yeah it might cost more okay, it might cost
2 more but now your house is going to be warm in the
3 winter and cool in the summer and as we talked
4 there's a value, I think you have to work it in there
5 because it will drive that decision.

6 MR. FRANCO: Thank you so much. Just to
7 clarify how we did it and what -- we did not consider
8 in that situation the heat pump to be an option if
9 they didn't have a central air conditioner so for
10 example the case would be say, for example, number 4.
11 The options are listed here, they would either have an
12 electric furnace --

13 MR. STANONIK: And I think that there's a
14 slight error in the analysis.

15 MR. FRANCO: I thank you for that comment,
16 we appreciate it.

17 MR. BROOKMAN: Please say your name.

18 MR. DRUMHELLER: Craig Drumheller
19 representing the National Association of Home
20 Builders. One of the components here that I think is
21 missing with fuel switching -- I represent the
22 National Association of Home Builders, we build

1 roughly a million homes a year and all of them have
2 to make decisions whether you are going to use gas or
3 electric but I think one of the components that is
4 missing here is deciding okay I am going to go to a
5 direct vent furnace so now what am I going to do with
6 my water heater?

7 Am I going to go with a direct vent gas
8 water heater, am I going to go to a B vent on my
9 water heater, or am I going to go to an electric water
10 heater -- so I think that's a major component that's
11 missing on this -- so you are talking about heating and
12 cooling comfort but you are not talking about water
13 heating and I think that's where a lot of my builders
14 said well that's what I'm probably going to do I am
15 not going to run a dedicated B vent for a water
16 heater -- so I think you should include that in your
17 analysis.

18 MR. FRANCO: Thank you, we appreciate that
19 comment.

20 MR. SACHS: Craig this is Harvey Sachs. I
21 think that is an important question and we certainly
22 have some empirical experience which was related to

1 me by a Massachusetts utility that the builders in
2 their area were responding in a very constructive and
3 cumulative even way. What they did is install the
4 condensing furnace and then they installed a power
5 vented gas water heater, low efficiency and then they
6 offered the chimney as an expensive adder so that
7 people could have a fireplace.

8 Once they had gone to the condensing
9 furnace and the power vent they kept all of the
10 amenity of gas and built themselves in a very nice
11 option that most people chose to go upscale with.

12 MR. BROOKMAN: I think now we are moving
13 on to slide 78, Dave Schroeder?

14 MR. SCHROEDER: In the fuel switching
15 logic the model chooses whatever option has the
16 longest payback period and assuming that there is one
17 over 3 years. If there are two over 3 years
18 what's the rationale for choosing the one with the
19 longest rather than the lowest first costs -- because
20 presumably people are considering switching because
21 of first cost issues.

22 MR. FRANCO: Again to thank you we did not

1 trust that that was one of the questions that you had
2 asked -- that was just a simplification -- we assumed that
3 was the greatest one, please submit comments that you
4 think how that can be improved, thank you.

5 So these are the results -- these results
6 presented here are with fuel switching so when you
7 see for example 90% a fraction of these results are
8 actually switching to either a heat pump or electric
9 furnace or going from a gas water heater to an
10 electric water heater. This presents a simple
11 payback and the overall system. The next slide
12 presents the impacted consumers and the average LCC
13 savings.

14 The next slide actually compares the
15 results between without switching and with switching.
16 In the appendix we also provide different scenarios
17 for the switching so you can look at what would
18 happen if there was a difference in switching a
19 fraction in terms of changing the payback criteria.

20 So you can take a look at that analysis in
21 the appendix 8J.

22 MR. BROOKMAN: Neil?

1 MR. LESLIE: Could you maybe explain why
2 the payback period drops when you start to put fuel
3 switching in there compared to without fuel
4 switching?

5 MR. FRANCO: Thank you for that question
6 and that's a question you have provided. The -- you
7 can think of it as the LCC results that is a
8 distribution. Most of the people that would be more
9 negatively impacted would be in this negatively
10 impacted distribution. If they find this equivalent
11 to be benefitting because they have a lower cost and
12 maybe their operation costs are not that different
13 they would be more positively impacted than if they
14 were with going with the standard.

15 Because of that the overall payback
16 decreases and the LCC savings decrease. Now if you
17 notice from this slide note that for example the
18 switching -- without switching and with switching
19 fractions are very, very similar so they are still
20 pretty much being negatively impacted but they are
21 less negatively impacted on average.

22 This does not mean that all households are

1 not more negatively impacted -- say for example they
2 decide to install electric furnace, maybe over the
3 lifetime they will have significant operating costs
4 but on average the payback does decrease and the LCC
5 savings on average increase.

6 But this analysis is done household by
7 household, so household to household they will be both
8 negatively and positively impacted, does that answer?

9 MR. LESLIE: Mostly I guess -- my other part

10

11

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12

13 of this is when you run it, with and without switching
14 them, is it expected that a different house will be
15 impacted with in the without switching version
16 compared to with switching? In other words, how
17 do I get from the 9 to the 7.7 using the same house
18 or is it a different house that wound up winding up
19 having a net cost or is it the same house with a net
20 cost but that when you switch then you accrue a
21 benefit by switching?

22

MR. FRANCO: So one feature of Crystal

1 Ball and again it's a little bit technical, but one
2 feature of Crystal Ball is they can actually sample --
3 if you do different scenarios -- you sample the same
4 household, so what we do with and without switching,
5 you are sampling the same household so essentially
6 what you are doing is in this area with product
7 switching the household that switched for example
8 will choose a heat pump and that's the -- the
9 benefits in terms of the heat pump going from 80%
10 that they wish to install and not having to install a
11 heat pump and the results without switching that same
12 household economics are going from because there was
13 no switching it would need to go to the condensing,
14 that's 90% or 92% whatever the standard, wherever the
15 level we are looking at.

16 Hopefully that answers.

17 MR. BROOKMAN: Mark Nayes, I almost
18 dropped you out, you are next, please go ahead.

19 MR. NAYES: Yes, I want to go back to the
20 inability to install certain condensing furnaces and
21 certain condominiums. I can get about 99.9% of homes
22 install a condensing furnace just by being able to be

1 creative but there are certain instances where like
2 in a condominium if you are on the lower level and
3 you have a vaulted ceiling, there is no wall you can
4 go through to vent out you are going to have the vent
5 going through your kitchen table, it is going to go
6 through your dining room window.

7 If you want to go through a different wall
8 you are going to someone else's living space and we
9 are not allowed to do that so what am I supposed to
10 do in that instance?

11 MR. BROOKMAN: Did you say 99.9, it works?

12 MR. NAYES: I can get it in just about
13 every instance. I can put a condensing furnace in
14 just about any home out there but there are some that
15 it doesn't matter what kind of money you put at it,
16 what kind of costs I put on it I cannot install it
17 according to code.

18 MR. BROOKMAN: Okay thank you. Bud
19 Miller?

20 MR. MILLER: Thank you, Bud Miller, APGA.
21 A number of times today the speakers indicated that
22 he would in the next generation revise certain things

1 to account for things that have been said in
2 questions and answers today. So my question, whether
3 it is of the speaker or you, John, is when will we see
4 this new iteration? Will it come with full
5 explanation and we will then have a revised comment
6 period to respond to that revised iteration?

7 MR. COHEN: Yes, I mean we are going to
8 have to look into this and talk it through really, it
9 depends on what the changes would be right. If they
10 are just sort of clarifications or corrections or
11 whatever we could just put another new version of the
12 spreadsheet in it doesn't really change the basic
13 thrust of what is up there now.

14 MR. BROOKMAN: So that was Dan Cohen.

15 MR. MILLER: And this is Bud Miller.
16 Hopefully if you do put up a new spreadsheet A -- you
17 will tell us about it, and B -- you will explain it
18 because we have had that problem in the past and then
19 we will have to decide if you don't provide a new
20 comment period whether to ask for one depending upon
21 what we see in terms of what you post, but notice is
22 very important in terms of when you post it and what

1 it reflects, what changes it reflects, thank you.

2 MR. CYMBALSKY: So before we move on so I
3 just wanted to recap for the benefit of the questions
4 for docket. We think we have got questions 1A and 4
5 in the section noted as previously asked and not
6 answered. We also think we have got question 1
7 related to installation costs and question 5 in the
8 previously asked and not answered, okay just to keep
9 that.

10 MR. BROOKMAN: Okay we are going to press
11 on here.

12 MR. FRANCO: This next slide and John will
13 present it.

14 MR. CYMBALSKY: So I will take this one.
15 We want to throw a few slides in here just to compare
16 the AGA analysis that has been out there, it is
17 actually in our docket as well compared to what we
18 have here in the NOPR so we just threw a couple of
19 slides up here to show that. I am not going to read
20 through here but you could see what we believe to be
21 the AGA assumptions in their modeling and so you can
22 see them there. If we advance the slide we could see

1 what the key differences here are so really when you
2 look at the analyses we have several levels of fuel
3 switching in both.

4 What really matters is when you do switch
5 my recollection is where it switches like in what
6 region of the country what the heating load is in
7 that switching situation and then all of the
8 economics that play out in terms of what we used in
9 our analysis which is what we presented here, the
10 prices that the AGA analysis has, how carbon factors
11 and things such as that change over time to get the
12 environmental benefits.

13 But you know we think that you know
14 everything that we have done in our fuel switching
15 analysis clearly has taken some good comment here
16 today but again we think the level of switching is
17 similar it is just you know what house switches and
18 where the house is and what the heating load is gets
19 you to a different answer in both of our studies
20 which is kind of a high levels.

21 MR. FRANCO: This answers a couple of
22 questions from AGA I think.

1 MR. CYMBALSKY: Yes, that is question 1C on
2 the previously asked and not answered.

3 MR. BROOKMAN: Steve Rosenstock?

4 MR. ROSENSTOCK: Just a very quick -- I have
5 not had a chance to see the AGA study. I know you
6 said it is on the docket. On slide 81 these
7 conclusions, which I would love to look into deeply,
8 are these annual figures or over 30 years? And there
9 are conclusions are those 30 year numbers? Annual?
10 Well I would have issues with a couple especially the
11 emissions thank you.

12 MR. BROOKMAN: Okay.

13 MR. FRANCO: So the next final piece of
14 the LCC is we do a subgroup analysis we take a look
15 from our sample of people that would be in the low
16 income or senior only. The results presented here
17 are the comparisons between the senior or low income
18 of all consumers.

19 The next slide just to finalize if there
20 are any additional comments for the LCC then we will
21 move on to the next.

22 MR. BROOKMAN: Yes, Mark Krebs?

1 MR. KREBS: Just one real short -- just to
2 reiterate what the comments in the furnace fan rule
3 from Sophie Miller that states that for those low
4 income groups you are vastly understating the
5 discount rate.

6 MR. BROOKMAN: Okay thank you, Mark Naves
7 has a comment -- it's a question in fact. If this is
8 designed to save energy why is the entire building
9 mechanical not being considered as a whole?

10 MR. FRANCO: The standard is only for
11 furnaces we only considered the furnaces on this
12 analysis, thank you for the comment.

13 MR. BROOKMAN: Frank Stanonik?

14 MR. STANONIK: This last slide -- hopefully
15 in one or two sentences you can explain how does the
16 average life-cycle cost for a senior only become
17 higher than for the nation? Wouldn't they have the
18 same installed price, cost of the furnace?

19 MR. FRANCO: This relates to the
20 distribution of these furnaces throughout the country
21 and the appropriate discount rate and so there's a
22 lot of economic factors you would have to look into

1 exactly the distribution of these and economics but
2 they are all -- everything is similar in terms of the
3 assumptions and this is the results of that.

4 MR. STANONIK: Follow up, Frank Stanonik,
5 AHRI. If that is true then why would you look at
6 senior only as a separate sub-group? They have to
7 have some significant changes and I guess I'll go
8 look at the TSD.

9 MR. FRANCO: Thank you for that comment.

10 MR. BROOKMAN: Neil?

11 MR. LESLIE: So I know we are all getting
12 very close to the end of the day here. First of all
13 I want to express my appreciation for the efforts you
14 all put into doing your best to answer questions that
15 are very thorny and maybe somewhat very challenging.
16 I appreciate the efforts and it doesn't matter
17 whether we agree or disagree with the answer what I
18 appreciate is the fact that you worked hard to figure
19 out an answer to them.

20 I have one last one sitting in here -- I
21 think aside from the West Virginia thing, you already
22 did it, thank you I was somewhere else at the time

1 even if I was here.

2 But I have a challenging question in here in that I'm
3 not sure what's equitable and how we get at equity so
4 it has to do with question number 4 on the overall
5 sheet and I am going to just ask it again and if you
6 feel you have answered it in the best way you can,
7 okay, but I am struggling still just a little bit.

8 So the question is and they are both
9 important. How are negatively and positively
10 impacted homes segmented? North, South, new
11 construction replacement, different options in
12 different home locations and sizes and configurations
13 as well as other factors that would impact consumer
14 classes differently -- our concern is that the
15 averages continue not to show the impact on marginal
16 effected consumers both positively and negatively.

17 I am not sure how to address that right
18 now but as you had offered to do your best to answer
19 all the questions that were on here I believe that is
20 the very last one I see that is in play in my mind
21 right now.

22 MR. FRANCO: Thank you for that question.

1 Kind of -- it was answered throughout the presentation.
2 Basically what we do is we segment the market in
3 terms of new construction, replacement in the
4 building sample, in terms of the building sample.
5 Once we produce the aggregate results the average of
6 all the 10,000, so for example, if you want to only
7 look at the results for the South out of the 10,000
8 that represents 4,701 households.

9 The disaggregation between of that --
10 between new construction and replacements would be
11 1,161 and 3,500 so you can actually if you had all
12 the 10,000 they will all be there in terms of they
13 are all disaggregated and all the inputs are
14 representative of what they should be for new
15 construction versus replacement. Hopefully that
16 answers.

17 MR. LESLIE: It's almost unanswerable I
18 know but the hope is that if we can identify and this
19 may be for some of the other folks that may be having
20 some discussions, different sub-categories that
21 matter. And that is what I was trying to get at,
22 both positive and negative not just negatively so

1 that people can appreciate and understand the impact
2 on different classes of consumers.

3 Locationally and size of home, income
4 classes, whatever type of granularity as you said
5 there is a lot of information in the 10,000 data
6 points and of that large set of information there was
7 a certain subset that deemed to be appropriate for
8 the rulemaking.

9 The concern that we have is that there may
10 need to be some additional granularity in this for a
11 good equitable rule.

12 MR. FRANCO: Thank you so much for those
13 comments, I appreciate it.

14 MR. BROOKMAN: Questions? Go ahead
15 please.

16 MR. DRUMHELLER: Craig Drumheller
17 representing the National Association of Home
18 Builders. These are just kind of my final statements
19 so that some of them are similar to what Neil has
20 just indicated.

21 They are very concerned that a large
22 section of the population will be negatively impacted

1 by this rule. Warmer climates, less expensive gas
2 areas, replacements especially those that exist in
3 finished areas. The analysis, just like any analysis
4 has a series of assumptions what I call knobs and it
5 appears that all of these knobs seem to be turned in
6 one direction.

7 The low discount rate -- we believe this
8 is unrealistically low. Consumers based on their
9 willingness to pay and alternative debt that they
10 have the discount rate should be closer to the 10,
11 12, 14% range. Energy cost escalation rate you know
12 historically they have been -- it has been much
13 flatter than is typically predicted by the Department
14 of Energy and projected material prices -- again all
15 of these knobs turn in the direction that
16 overestimate the payback.

17 While the consumers are typically willing
18 and these are surveys that NHB has done over and over
19 again about a 7 year payback, NHB adjusted their
20 policy a few years ago to say you know what we will
21 go to a 10 year payback but it is not really what the
22 people that buy the homes want. They want 7 but we

1 went to 10 just so we could be involved in some of
2 the conversations.

3 And DOE's numbers in a lot of cases go
4 above 12, 13, 14 years which is unrealistic
5 especially for a piece of equipment that your
6 estimates says 21 years and some of ours are even
7 closer to the 18, 16 year range. That's cutting it
8 rather close. Everybody needs to keep in mind this
9 is a minimum standard, everybody has to do this we
10 are not talking about Energy Star we are talking
11 about everybody must comply with this and we think
12 that this is overstepping.

13 Corrections to this problematic
14 requirements may be bifurcated standards maybe for
15 condensing and non-condensing and have separate
16 categories and separate requirements for each
17 category, potentially having regional North/South
18 requirements and in addition having exemptions for
19 replacements.

20 So hopefully you will consider that and we
21 will include that in our comments, thank you.

22 MR. BROOKMAN: Okay thank you.

1 MR. CYMBALSKY: So at this point I am just
2 going to announce that clearly we didn't reach the
3 finish line so we will see you all again on April
4 13th to finish the meeting so we will put out an
5 announcement and a blast and do a webinar 9 A.M.

6 So let's try 10 A.M. because I think we
7 will have some west coasters that may not want to
8 travel all the way back for the rest -- so it is a
9 Monday, April 13th -- yes. We will be here as well so
10 please mark your calendars, we are going to pick off
11 at the shipments and finish the rest of the slides.

12 And then at that point everyone can do
13 their closing remarks. I really appreciate everyone
14 for sticking around and really this was a great
15 dialogue a lot of good information. I know the
16 material was dense but we got through I think the
17 hardest part so I appreciate it. Thank you.

18 (Whereupon the meeting adjourned at 4:51
19 p.m.)

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