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Tutorial Spreadsheet Meeting 11-07-2014

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U.S. DEPARTMENT OF ENERGY

OFFICE OF ENERGY EFFICIENCY AND RENEWABLE ENERGY

BUILDING TECHNOLOGIES OFFICE

ENERGY CONSERVATION PROGRAM FOR CONSUMER PRODUCTS:

ENERGY CONSERVATION STANDARDS FOR RESIDENTIAL

FURNACES

TUTORIAL SPREADSHEET MEETING

CALL # 49279-01-EE-5B

WEDNESDAY, NOVEMBER 7, 2014

The above-referenced working group met
in Room 4A-104, 1000 Independence Avenue SW,
Washington, D.C., 20585 at 9:00 a.m., John
Cymbalsky, presiding.

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1 P R E S E N T

2 ASHLEY ARMSTRONG,
Office of General Counsel, U.S. Department of
3 Energy

4 DAN COHEN,
Office of General Counsel, U.S. Department of
5 Energy

6 JOHN CYMBALSKY,
Office of Energy Efficiency and Renewable
7 Energy, Building Technologies Office, U.S.
Department of Energy

8 ERIC STAS,
9 Office of the General Counsel, U.S.
Department of Energy

10 A L S O P R E S E N T

11 ADAM DARLINGTON,
12 Navigant Consulting

13 RACHEL FEINSTEIN,
Hearth, Patio and Barbecue Association

14 VICTOR FRANCO,
15 Lawrence Berkeley National Laboratory

16 LAURA PETRILLO-GROH,
Air Conditioning, Heating and Refrigeration
17 Institute

18 PETER HANSON,
Council on Environmental Quality

19 MARSHALL HUNT,
20 Pacific Gas and Electric Company

21 ROGER HUNT,
Lennox Industries

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- 1 DIANE JACOBS,
Rheem Manufacturing
- 2
- 3 CHRIS LAU,
Navigant Consulting
- 4
- 5 ALEX LEKOV,
Lawrence Berkeley National Laboratory
- 6
- 7 NEIL LESLIE,
Gas Technology Institute
- 8
- 9 JACKIE LONG,
Toxicology Council
- 10
- 11 TOM MASSARO,
New Jersey Natural Gas
- 12
- 13 WILLIAM MILLER,
McCarter & English;
General Counsel, American Public Gas
Association
- 14
- 15 NICK MISLAK,
Air Conditioning, Heating and Refrigeration
Institute
- 16
- 17 ELIZABETH NOLL,
National Resource Defense Council
- 18
- 19 HENRI ADROIT (sp),
Goodman Manufacturing
- 20
- 21 ANDREA PAPAGEORGE,
AGL Resources
- 22
- 23 GREG ROSENQUIST,
Lawrence Berkeley National Laboratory
- 24
- 25 DAVE SCHROEDER,
Consultant, Gas Technology Institute
- 26
- 27 DAVE SCHRYVER,
American Public Gas Association

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- 1 DON SORINO,
National Association of Home Builders
- 2
- 3 FRANK STANONIK,
Air Conditioning, Heating and Refrigeration
Institute
- 4
- 5 ALISON WILLIAMS,
Lawrence Berkeley National Laboratory
- 6 DAVE WINNINGHAM,
Allied Air Enterprises
- 7
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1 P R O C E E D I N G S

2 MR. CYMBALSKY: Okay. Welcome to the
3 public meeting to demonstrate our spreadsheet
4 analytical tools. My name is John Cymbalsky. I
5 am the program manager for appliance standards
6 here at DOE. I want to first welcome everybody
7 and thank everybody for coming.

8 Today's workshop will focus on
9 presenting our analytical spreadsheets that we use
10 for all of our rulemakings, and the purpose here
11 is to give interested stakeholders an overview and
12 maybe a little more in-depth knowledge of how to
13 use the spreadsheets, how to find certain key data
14 inputs and whatnot.

15 What the meeting is not about, and our
16 general counsel will speak more specifically on
17 this, it's not about the furnace proposal that is
18 at OIRA. So questions about, you know, why this or
19 how that are deliberative to the rulemaking and we
20 will answer at the public meeting for the NOPR in
21 due course when that comes out of OIRA.

22 Also, the meeting today is being

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1 broadcast on the Web via webcast. People on the
2 webcast can ask questions by raising their hand.
3 We will try to patch you in, in audio. If that
4 doesn't work, we will write down your question and
5 read it.

6 Now, at this time, I'd actually like to
7 go around the room, everyone introduce themselves.
8 A few ground rules, when you do have a question,
9 the microphone has a little button. Push it on.
10 Green light will come on to speak. When you're
11 done, please push it off so we don't get feedback.
12 And again, state your name and association every
13 time you'd like to speak. So we'll start over
14 here to my left with Bud.

15 MR. MILLER: Thank you, John. My name
16 is William Miller, with McCarter and English,
17 general counsel for the American Public Gas
18 Association.

19 MR. ADROIT: Henri Adroit, Goodman
20 Manufacturing.

21 MR. LESLIE: Neal Leslie, Gas Technology
22 Institute.

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1 MR. SCHROEDER: Dave Schroeder,
2 consultant for the Gas Technology Institute.

3 MS. PETRILLO-GROH: Laura Petrillo-Groh,
4 Air Conditioning, Heating and Refrigeration
5 Institute.

6 MS. PAPAGEORGE: Good morning. Andrea
7 Papageorge, AGL Resources in Atlanta.

8 MS. JACOBS: Diane Jacobs, Rheem
9 Manufacturing.

10 MS. NOLL: Elizabeth Noll, NRDC.

11 MR. M. HUNT: Marshall Hunt, Pacific Gas
12 and Electric Company.

13 MR. WINNINGHAM: Dave Winningham, Allied
14 Air Enterprises.

15 MR. MASSARO: Tom Massaro, New Jersey
16 Natural Gas.

17 MR. R. HUNT: Roger Hunt, Lennox
18 Industries.

19 MR. STAS: Eric Stas, DOE general
20 counsel's office.

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

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1 MR. ROSENQUIST: Greg Rosenquist,
2 Lawrence Berkeley National Laboratory.

3 MR. COHEN: Dan Cohen, general counsel's
4 office, DOE.

5 MR. LAU: Chris Lau, Navigant.

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

8 MR. DARLINGTON: Adam Darlington,
9 Navigant.

10 MR. CYMBALSKY: And those in the
11 gallery, if you could just stand and speak loudly
12 and introduce yourself.

13 MR. HANSON: Peter Hanson, Council on
14 Environmental Quality.

15 MS. LONG: Jackie Long, Toxicology
16 Council.

17 MR. SCHRYVER: Dave Schryver, APGA.

18 MR. MISLAK: Nick Mislak, Air
19 Conditioning, Heating and Refrigeration Institute.

20 MS. WILLIAMS: Alison Williams, LBL.

21 MR. SORINO: I'm Don Sorino with the
22 National Association of Home Builders.

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1 MS. FEINSTEIN: Rachel Feinstein, with
2 the Hearth, Patio and Barbecue Association.

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

5 MR. CYMBALSKY: Okay. So I think we've
6 got everybody introduced. And at this time, I'm
7 going to turn it over to Eric for a quick
8 statement.

9 MR. STAS: Okay. This is Eric Stas, DOE
10 general counsel's office. I'd like to reiterate
11 John's welcome and thank you all for coming to the
12 meeting today, and I just wanted to say a few
13 words about the overall purpose of the meeting
14 today and the types of questions DOE will and will
15 not be answering.

16 So as John said, DOE has convened this
17 meeting as a tutorial on the department's analytic
18 tools and spreadsheets used across DOE's appliance
19 rulemakings. So we'll discuss as necessary the
20 models and inputs for conducting the Monte Carlo
21 analysis and other analyses that generate data and
22 results used in those rulemakings.

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1 The goal is to allow interested parties
2 to understand and work with those analytical
3 tools, thereby gaining insight into how DOE
4 generates the data and results for any given
5 rulemaking. So and to illustrate these analytical
6 tools, DOE has made available its preliminary
7 results for the ongoing rulemaking to consider
8 amended energy conservation standards for
9 residential, non-weatherized gas furnaces and
10 mobile home gas furnaces.

11 But as John said, please note that this
12 data is being offered for illustrative purposes
13 only as part of this tutorial, and DOE will not be
14 answering questions pertaining to any policy
15 decision, model assumptions or other deliberative
16 matters regarding the draft furnaces at this time.
17 The notice of proposed rulemaking, as John said,
18 for the amended furnaces standards has been
19 submitted to OMB for interagency review, and
20 consequently the document's not yet publicly
21 available. It's in draft form, and it's subject
22 to change.

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1 So once the document has been published,
2 however, DOE will convene another public meeting
3 to discuss and receive comments on the proposed
4 rule and at that time, DOE will entertain any
5 questions regarding the proposed standards, policy
6 assumptions, data, policy decisions and there will
7 be another opportunity for public comment and data
8 submission.

9 So focusing again today, the purpose of
10 today's meeting is to enable stakeholders to
11 understand and utilize DOE's spreadsheets and
12 analytical tools, thereby facilitating stakeholder
13 review of the proposed rule for furnaces and any
14 other DOE rule and to enhance the opportunity for
15 public -- meaningful public comment. So if we can
16 stick to those sort of ground rules, it'll
17 facilitate the meeting.

18 MR. CYMBALSKY: Okay. Thanks, Eric. I
19 do want to mention that the meeting runs to 1:00.
20 We do have a hard stop at that time. If we feel
21 like we need to reconvene to go into more detail
22 on some of the spreadsheets, obviously DOE will

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1 entertain that request. So at this time, we'll
2 open the floor for opening remarks and/or
3 questions about what Eric just stated.

4 MR. MILLER: I guess to the extent
5 questions are offensive from the standpoint of
6 what Eric just said, we'll be told at the
7 appropriate time. I mean, APGA -- first of all, I
8 would just say APGA appreciates and AGA
9 appreciates that this meeting is being held.

10 We requested it several weeks ago
11 because of our inability to understand these very
12 complex spreadsheets. And at Dan Cohen's request,
13 we submitted questions and hope you will proceed
14 to those questions shortly. We have not heard
15 back about those questions. So we're assuming
16 those questions passed muster in terms of the
17 standards you just articulated. But I guess we'll
18 be told that as we go through this exercise.

19 We would like to proceed through the
20 questions in the order in which they were
21 submitted. Obviously, when we get answers, there
22 will be follow-up questions and answers I'm sure.

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1 And you know, I made that clear in my email to Dan
2 Cohen.

3 So we appreciate DOE having this
4 meeting. We hope to come out of it with a much
5 better understanding of the spreadsheets and how
6 they operate than we have today. And also,
7 obviously if there's a follow-up meeting after a
8 rule -- proposed rule issues, that will be
9 important as well. And we would have much
10 different questions I'm sure at that meeting than
11 we have today.

12 But with that, subject to other folks
13 saying whatever they want to say, I would turn it
14 over to Neil Leslie and his colleagues at GTI to
15 march through the questions that we have already
16 submitted to DOE. Thank you.

17 MR. CYMBALSKY: Anybody else wish to
18 make opening remarks? Okay, Frank?

19 MR. STANONIK: Frank Stanonik, AHRI.
20 Just I'll say a general prefatory statement. I
21 recognize what Eric has said and what the intent
22 of the meeting is. I'd just ask you to appreciate

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1 that at the moment, our understanding of the
2 spreadsheets is kind of limited to the outputs we
3 see.

4 So I'm going to -- you know, I probably
5 will pose some questions in terms of outputs that
6 I see that, you know, raise questions. And if
7 certainly we get off-chart here or off the task,
8 yeah, as I think was said, we'll assume you'll
9 pull us back.

10 But right now, you know, I'm sitting
11 here thinking the only way I can ask you questions
12 is because I see outputs that I don't understand,
13 relative to how you use the tool. And I
14 understand we're not going to talk about the
15 furnace rulemaking directly.

16 But just kind of, you know, I guess
17 appreciate from our perspective right now, the
18 only way I can relate to that information and the
19 tools is what I'm seeing as outputs.

20 MR. CYMBALSKY: Right, and we appreciate
21 that. John Cymbalsky, DOE. I think maybe a
22 little example might help and frame up how. So a

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1 question, for example, an important aspect of the
2 furnace rulemaking, for example, is fuel
3 switching. And the spreadsheets, the analytical
4 tools have information about fuel switching in
5 them.

6 So an appropriate question in my mind
7 is, DOE, can you point us to in the spreadsheet of
8 where we can find out about how you accounted for
9 fuel switching. And Victor will do that. The
10 inappropriate question is obviously the question
11 you probably want to ask but I don't think I need
12 to ask it. But when you do, we'll tell you we
13 can't answer it. Does that help?

14 MR. STANONIK: Well --

15 MR. CYMBALSKY: I know, it doesn't -- it
16 doesn't help-help, but --

17 MR. STANONIK: My intent will not be to
18 ask those question, but you know, without getting
19 a better sense of how we -- I'm sorry. My intent
20 will be not to ask those questions because I
21 understand what's been said here. But until we
22 get a little further along and get a good sense of

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1 it, I mean, your example helps. Thanks.

2 MR. CYMBALSKY: Okay, anybody else wish
3 to make an opening statement. Okay, so for full
4 disclosure on Bud's -- oh, I'm sorry.

5 MS. JACOBS: Diane Jacobs from Rheem.
6 So I was here yesterday and you said that the
7 spreadsheet, the same format is used in all the
8 rulemakings or most of them, all of them. So I
9 think that it's good to point out in other
10 contexts, you know, what -- how it's used and it
11 seems like maybe there's parts that come in or
12 come out depending on the rulemaking. So I'm
13 really interested in how it's applied in general.
14 Thank you.

15 MR. CYMBALSKY: Right, and this is John
16 again from DOE. So that's right. So for example,
17 the life cycle cost spreadsheet, it fundamentally
18 does the same thing in all the rulemakings. Now,
19 for furnaces, there are different aspects that
20 need to be accounted for that you won't see in
21 like a refrigerator spreadsheet.

22 So I'm assuming questions today, because

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1 this one in my mind's probably a little more
2 complicated than most, will be specific to
3 furnaces. But at the same time, we're asking a
4 question about, you know, how in the analytical
5 tools can we access that and maybe play with some
6 of the parameters, et cetera. So that carries
7 over to all the other products where applicable.

8 So any other opening remarks? So to
9 address Mr. Miller's comments about questions, so
10 for full disclosure, there were questions that
11 were sent to DOE. The way we want to try to
12 answer the questions that we can answer, because
13 it is a subset -- we'll be honest with you -- as
14 Victor goes through the spreadsheet, he is aware
15 of the issues and he questions that were raised,
16 and we will try to answer them interactively with
17 the spreadsheet demonstration. And if that doesn't
18 suffice, of course you're free to ask your
19 questions as well. So yes, Neil?

20 MR. LESLIE: This is Neil Leslie, GTI.
21 Just a clarifying thing on when it's appropriate
22 to ask the questions as the spreadsheet is being

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1 described.

2 MR. CYMBALSKY: Yes, so --

3 MR. LESLIE: When do you want them?

4 Anytime or just wait until the end or how do you
5 want to do that?

6 MR. CYMBALSKY: No, no. So John, DOE,
7 so if Victor's on cell AA 135, and that sparks
8 your question about something, you ask the
9 question and we'll answer it. Anybody else?
10 Okay, all right. Let's move on. So at this point,
11 Victor is going to be our point man for bringing
12 you through the analysis in the spreadsheet. So
13 we are going to switch spots and take it from
14 there.

15 MR. FRANCO: Hi. Good morning. I'm
16 Victor Franco from Lawrence Berkeley National
17 Laboratory and I will be going through the
18 spreadsheets. I will be going through actually
19 two spreadsheets, the life cycle cost analysis
20 spreadsheet and the national impact analysis
21 spreadsheet.

22 This is kind of -- this flow chart is

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1 going to show you more or less what's the flow and
2 the connection between the two. So we have various
3 inputs. These are just some of the primary inputs.
4 So some of the analysis that goes in, for example,
5 is manufactured cost that comes from the
6 engineering analysis, markups to determine that
7 product price, energy use characterization and
8 then there's a lot of other inputs that we'll go
9 into.

10 The outputs that come out of that, the
11 results are LCC savings and the payback period.
12 Also, out of that, there's LCC outputs that are
13 some of the primary inputs to the national impact
14 analysis spreadsheet. In addition, there's the
15 shipments analysis that goes into that spreadsheet
16 as well. And from that spreadsheet, we have the
17 national energy savings and net present value.

18 So as I go through these introductory
19 slides are just to show you more or less to remind
20 you about the analysis, what we're trying to do in
21 the spreadsheet and how -- what worksheets we're
22 going to be going through and how they are set up,

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1 and hopefully that will make it a little bit
2 clearer as I go through the spreadsheets, what
3 part of the analysis I'm going through.

4 So this is a flow chart that we usually
5 present in the rulemakings just to show the flow
6 of the LCC and payback period analysis.
7 Basically, the yellow presents the final results,
8 payback period and life cycle cost. And the green
9 are the primary inputs -- for example, total
10 installed cost and the annual operating expenses.
11 And then, obviously those have a lot of inputs
12 that each of them actually becomes a worksheet, as
13 we'll see in the next slide -- actually, after
14 this one.

15 So basically, just to remind you, the
16 life cycle cost is total installed cost plus
17 operating cost and it's the operating cost of the
18 lifetime of the product discounted to the base
19 year. And in the case for furnaces, it's 2021.
20 Obviously it's different for each rulemaking.
21 We're evaluating -- yes?

22 MS. JACOBS: Diane Jacobs, from Rheem.

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1 So where do you come up with that year, 2021?

2 MR. FRANCO: So that's the year that the
3 standard is going to take into effect and that
4 just depends on the rulemaking.

5 MR. CYMBALSKY: So this is John from
6 DOE. So again, that's a furnace-specific number.
7 So depending on the rule, it's the first year of
8 compliance. So that changes.

9 MS. JACOBS: Okay.

10 MR. MILLER: Bud Miller. Are these
11 slides available today?

12 MR. CYMBALSKY: We will make slides
13 available. For the meeting, we want to keep this -
14 - we want to keep everyone's eyes focused on the
15 screen because we're going to be doing spreadsheet
16 stuff and having a stack of paper in front of you
17 I don't think is the best way to do that. We will
18 make the printed slides available though.

19 MR. MASSARO: It's Tom Massaro with New
20 Jersey Natural Gas. Victor, a question on the
21 installed cost. It looked like the installation
22 cost wasn't a variable.

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1 MR. FRANCO: This is Victor Franco. Let
2 me go back to the previous slide. So the
3 installation cost is the one that's right before
4 the consumer price. That would be the --

5 MR. MASSARO: Right, right below the
6 consumer?

7 MR. FRANCO: Yes.

8 MR. MASSARO: That's not an input?

9 MR. FRANCO: That is an input.

10 MR. MASSARO: Oh, okay. It wasn't
11 green. All right. I think anything in green was a
12 --

13 MR. FRANCO: Those are kind of like the
14 -- except for consumer price because it has a lot
15 of other inputs. But installation cost is
16 obviously a major input to the total installed
17 cost. Those were the two.

18 MR. MASSARO: Right.

19 MR. CYMBALSKY: So this is John at DOE.
20 So we will get into the spreadsheets and you will
21 see those numbers and where they are.

22 MR. FRANCO: So again, this is we're

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1 looking at the -- we're evaluating the economics
2 through the consumer perspective in the LCC
3 analysis. And to do this in the spreadsheet form,
4 we use the analysis and the variability using a
5 Monte Carlo approach. What that means essentially
6 is for certain inputs we have a distribution and
7 we'll go through that as we look at the
8 spreadsheet.

9 Now, in terms of the tools, and we'll go
10 through this with more time, it's basically to
11 view the tool, you need Excel spreadsheet. Now,
12 to actually understand a little bit more look at
13 the distributions, you'll actually need a program
14 add-in which is called Crystal Ball, and we'll go
15 into more details about that. You don't
16 necessarily need Crystal Ball to look at the
17 spreadsheet.

18 But if you want to run the spreadsheet,
19 want to look more carefully at some of the inputs,
20 you will need that add-in. And we'll go through
21 that.

22 MR. SCHROEDER: Dave Schroeder. So some

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1 variables are coming in through Crystal Ball and
2 some are not. That's correct?

3 MR. FRANCO: Yes. This is Victor
4 Franco. We'll look at that more carefully as we go
5 through the spreadsheet and you'll have an
6 understanding. Most of the variables that are
7 kind of -- that are coming in from Crystal Ball
8 are the ones that are generated by a distribution.
9 We also use Crystal Ball to kind of summarize the
10 results, as we'll go in more detail.

11 MR. SCHROEDER: So is that -- is that
12 the same for every one of these rulemakings, which
13 variables are and aren't controlled by
14 distributions. How is that decided and what --
15 which variables go in which bucket?

16 MR. FRANCO: Victor Franco. This really
17 depends on the rule. But in generally, a lot of
18 them are distributions, especially if we have data
19 that we know that this should be represented as a
20 distribution.

21 So for example, and we'll go through
22 examples of course as we go through the

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1 spreadsheet. But for example, lifetime is usually
2 a distribution. There's other variables as we go
3 through. And it's very similar to rulemakings.
4 But obviously there's some rulemakings you don't
5 have a lot of data and that might not -- you don't
6 know what the distribution might be.

7 So let's go. So this is the structure
8 of the spreadsheet. Obviously you'll have this
9 later to kind of look at this. We might go back
10 just to see the flow of the structure if needed
11 when we're presenting the spreadsheet. But I want
12 to go through this a little bit for you to
13 understand and obviously once we get into the
14 spreadsheet, we'll review it again.

15 So the main kind of calculations for the
16 LCC and payback is in a worksheet that we'll spend
17 a little bit of time called LCC and payback
18 calculations worksheet, and that's where
19 essentially the LCC and payback calculations are
20 being conducted. Everything else is an input to
21 that spreadsheet. From that, once you run the
22 spreadsheet, basically you need a -- we've done a

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1 macro to generate results at the end -- you
2 produce something else called forecast cells. And
3 we'll go what that means.

4 Basically those are generated with
5 Crystal Ball in a macro. Those forecast cells are
6 the results of conducting the Monte Carlo
7 analysis, and usually for all these rulemakings we
8 set it up to 10,000. You have options to do more
9 or less. But this is what we've come up with as a
10 good value of generating the results. From those
11 forecast cells, we generate the final results. So
12 for example, we have the summary worksheet, which
13 we'll go into, some statistics and LCC outputs
14 that go to the NIA.

15 Now, as you've seen from before, we have
16 all these key parameters which are the same. So
17 for example, we have equipment price, installation
18 cost, energy use, energy price, energy price
19 trends, lifetime discount rates and then there's
20 data worksheets that are also for each of these
21 and so you can see what goes with what. We'll go
22 through each one of them carefully and the ones

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1 that are related. For example, equipment price,
2 we'll talk about markups and equipment price
3 trends.

4 An additional one is the building
5 sample, and I will take more time to discuss that
6 one as well. So obviously I didn't want you guys
7 to read it. This is mainly once you have the
8 printout. This explains each of the worksheets
9 before and a description. And this is primary for
10 you to take after the meeting and be able to look
11 at and compare and say, oh, he was talking about
12 the statistics, oh this is what this is, non-
13 itemized switching, this is what this is.

14 I don't want to go through the
15 descriptions obviously. Just want to point out
16 something that's very critical. We've listed here
17 there's an asterisk. Hopefully you can see it, for
18 some of these. There we go. That's right here
19 for some of these and there's a note at the
20 bottom.

21 So the results that are displayed in
22 that worksheet are only for the household that's

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1 being calculated. So it's just one household
2 that's being calculated at that time. Once you
3 run the macro, you actually run it through 10,000
4 times and you get the final results. So it's very
5 important because sometimes it's confusing what's
6 actually the final result of the 10,000, what's
7 actually just one household result.

8 There's a lot of worksheets, so this is
9 again the second. So just to present a little bit
10 of how the worksheets are set up, so this is
11 obviously when you open up the presentation, this
12 is something that you -- I mean, the spreadsheet
13 you want to look at. You want to look at the
14 final results and this also gives you a way to
15 generate new results if you wanted to. So
16 basically this is the summary worksheet. On the
17 right, there'll be results.

18 Now, it depends on the product that
19 you're dealing with, what kind of results you'll
20 be getting. For the furnaces rulemaking, we've
21 disaggregated some of the results by region and
22 market, say like new construction, and

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1 replacements to give people that are looking at it
2 more of a sense of what's going on in these
3 submarkets. That's not very usual.

4 Usually results is just presented
5 national. So this is one difference, furnaces with
6 -- but it depends. There's other rules that you
7 find something like this. Another difference is,
8 for example, you have standby results that are
9 different from the actual standard, AFUE standard.
10 So there's a lot of results represented. Another
11 thing that we usually have in these spreadsheets
12 is some kind of instruction to kind of lead you to
13 how to use the spreadsheet in case you wanted to
14 actually run it, change some of the variables.

15 And the user options are right here on
16 top, and those are the ones that we've set up so
17 that they can change. And this has been evolving.
18 It depends on the product. One, for example,
19 that's very different is we have this switching.
20 And you can actually turn off and on the switching
21 and see what the results are. Something that's
22 usually available in all these rulemakings is, for

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1 example, the energy price trends or changing the
2 start year.

3 Something else that's useful is we could
4 sometimes -- these spreadsheets are large and it
5 might take quite a bit of processing time to
6 actually generate the final results. We have this
7 option of trial numbers. So in case we wanted to
8 run this spreadsheet today, we would change this
9 to a lower number and generate results, and you
10 can change that as a user. This is also important
11 just to kind of give you a sense of what we're
12 going to be talking about today in all these input
13 worksheets, kind of the setup.

14 So we've tried to make it as useful or
15 as easy for the user to kind of navigate through
16 the spreadsheets. But we understand that these
17 are pretty difficult to understand, especially if
18 you don't know the product. But we've tried to
19 make it as user- friendly as possible. So a lot
20 of these worksheets are set up in the following
21 manner. You'll have a data throughout. For
22 example, this is the markups. And so, for example,

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1 on markups, we have markups -- sorry about that --
2 markups that are divided by region. And you can
3 see the regional numbers and that's the data.

4 Then you have some other inputs that are
5 coming from other parts of the spreadsheet. For
6 example, in this case we are a region. For
7 example, a specific household, you probably can't
8 really see it but I'll say it verbally, 21, region
9 21, which represents Texas. So this specific
10 household is in Texas. For that household, it's
11 actually replacement and so it'll use a certain
12 input from these markups. And here on this side
13 are the calculation. Calculations sometimes vary
14 between spreadsheet and spreadsheet.

15 In this, we thought that this was easier
16 to visualize in this manner. But it depends on
17 the worksheet and we'll go through that. The
18 final piece is actually the export value and this
19 goes to another worksheet or might actually go to
20 that LCC and payback calcs worksheet.

21 MS. JACOBS: This is Diane Jacobs from
22 Rheem. So just kind of to go back, so we're in

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1 the LCC and PB worksheet, right, or spreadsheet.

2 MR. FRANCO: Right now we're in the
3 specific worksheet that's generating the markups.

4 MS. JACOBS: But that's part of --

5 MR. CYMBALSKY: Inside the life cycle
6 cost worksheet.

7 MS. JACOBS: It's a life cycle cost
8 spreadsheet.

9 MR. FRANCO: That's correct.

10 MS. JACOBS: And I think you just said
11 that the results when you run that are for a
12 single household. But now, you're saying the data
13 is for all these cities and regions.

14 MR. FRANCO: No, no. So yeah, let's go
15 over it.

16 MS. JACOBS: Okay.

17 MR. FRANCO: This is Victor Franco
18 again. Let's go -- this is very important to start
19 with. And we'll go through this every worksheet.
20 We'll review it. But you open up the spreadsheet.
21 You go to this worksheet which is called markups,
22 and you'll see that this -- the results that are

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1 being calculated here are for that specific
2 household, just one household.

3 MS. JACOBS: Okay, to respond, so it's
4 like a look-up table.

5 MR. FRANCO: Yes.

6 MS. JACOBS: So depending on what your
7 input is, it's looking in there and picking one
8 number for one house.

9 MR. FRANCO: Correct. So for example,
10 just an example here and we'll go through this
11 more carefully, is this household is in Texas. So
12 it will pick up the values that are appropriate
13 for that region in Texas. So that's -- yes.

14 MR. CYMBALSKY: So we have a question
15 from Julie Hatfield, asking why we have -- using
16 2003. She feels that's outdated. I believe she's
17 referring to the CBECS 2003 survey, and so, that's
18 kind of unfortunately the last CBECS that was
19 published in its entirety. So DOE would
20 appreciate some more recent data. So Julie, if
21 you have that, please forward it on to DOE. Thank
22 you for the question.

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1 MR. FRANCO: Thank you. Victor Franco.
2 So this is -- it kind of ends the introduction to
3 the LCC spreadsheet. Let me move on to the NIA.
4 Once we finish with that introduction, then we'll
5 go into the spreadsheet. So only a few more
6 slides and we'll actually go to the spreadsheets.

7 So this is a lot of information
8 obviously. Let's just focus on some of these
9 inputs and outputs. This is kind of the analysis
10 flow chart and then we'll go into the spreadsheet
11 flow chart. So the things we want to focus on
12 first is, as before, we're saying primary input to
13 the NIA is shipments and LCC outputs. Some of
14 those are the actual outputs that are necessary --
15 for example, consumer price, installation cost,
16 energy prices, energy consumption.

17 And then, there's others because the NIA
18 is doing this very long period of time. So
19 there's trends that are also built in. And at the
20 end, from all this we get the two primary results,
21 the net present value and the energy -- national
22 energy savings.

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1 MS. JACOBS: Diane Jacobs, from Rheem.

2 So you said that trends over a long period of
3 time. Is it always 30 years you're trying to
4 forecast?

5 MR. CYMBALSKY: So this is John
6 Cymbalsky, DOE. The 30 years represents the
7 analysis period for the number of shipments that
8 are going to be analyzed. So the analysis period
9 takes 30 years of shipments and then extends it
10 until the last years' worth of shipments have been
11 retired from the stock. So depending on the
12 product, transformers for example has a 30-year
13 life. So 30 plus 30, it would be a 60-year
14 analysis, so to speak.

15 MS. JACOBS: Okay. So I think furnaces
16 was 26. So it's be 56.

17 MR. CYMBALSKY: Fifty-six, correct.

18 MS. JACOBS: Okay, thank you.

19 MR. FRANCO: So let me move on to --
20 obviously you'll have this so hopefully this is
21 useful for you to -- once you go back to
22 understand this spreadsheet. Let's move on a

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1 little bit, just where we're talking about the 30-
2 year pay period, analysis period. So we're
3 looking at, for furnaces, just specific for
4 furnaces, the shipments between 2021 and 2050.

5 After that, then we're just looking to
6 make sure everything is retired and we're
7 analyzing those retirements. Basically the energy
8 savings -- the national energy savings are the
9 primary energy savings and the NPV is the
10 difference between the present value of the
11 savings of the annual operating cost and the
12 present value of the increased annual total
13 installed cost between the base case, which is
14 without the standards, and these standard cases.

15 Now, how the spreadsheet works is
16 there's a macro that we've built in to generate
17 the final results. Again, this is using a
18 spreadsheet. So you can open it up and take a
19 look at it. It has a macro, so you don't need any
20 additional add-ins or anything. You can actually
21 just use it right away.

22 And there's one thing to understand

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1 that's critical is that the individual worksheets,
2 when you look at the intermediate results, are not
3 the final results but they represent either the
4 results for a certain region, in this case we've
5 divided it between north and the rest of the
6 country, and a market-type representation,
7 commercial. When we get to the NIA, we'll look at
8 it more carefully of how that's represented. But
9 also I'll show that in the next slide to just go
10 over it a little bit.

11 MR. CYMBALSKY: Victor? Victor?

12 MR. FRANCO: Sure.

13 MR. MILLER: So is the macro -- the
14 result you get using the macro, is that a Crystal
15 Ball result? So it has the -- it is this 10,000
16 iterations?

17 MR. FRANCO: No, sorry. Let me make
18 that very clear. No. So the LCC outputs
19 obviously is the result of the 10,000. Once you
20 get to the NIA, you already have that result. And
21 in the NIA, you use the macro to kind of go
22 through the different iterations. You calculate

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1 the results for the north. You copy and paste --
2 the macro copies and pastes that and it generates
3 the results for the rest of the country.

4 And obviously actually it goes north,
5 residential, north commercial, rest of the county
6 residential, rest of the country commercial and it
7 generates the final results. And we can actually
8 see that once we get to the spreadsheet. It'll
9 probably be easier to visualize.

10 MR. CYMBALSKY: So this is John from
11 DOE. So Victor, is it safe to say that the Crystal
12 Ball add-on is only needed for the LCC?

13 MR. FRANCO: That's correct, yes. The
14 LCC, yeah, is the only one that uses the Crystal
15 Ball add- in. So this again gives you a sense of
16 how the spreadsheet works. And the individual
17 worksheets. So let's start from the outputs.

18 So essentially when you open up the
19 spreadsheet, what you want to see is the results
20 and this is available in the NIA summary. Those
21 results are being generated from a couple
22 worksheets that are kind of the accounting

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1 spreadsheets and they have different calculations
2 that are going on. I'll go through those.

3 Basically for this product, we're using
4 -- we have two product classes. So they're
5 calculated differently. We have non-weatherized
6 gas furnaces and mobile home gas furnaces. Now
7 we're going to be mostly talking about non-
8 weatherized gas furnaces. But in case you have
9 questions, let me know.

10 And those specific worksheets actually
11 calculate three things kind of at the same time.
12 They're accounting for three things. And I just
13 wanted to empathize that. Both they take in the
14 economic and energy use inputs and they process
15 those. And they also take historical shipments
16 and those to actually calculate the shipments.
17 And for non-weathered gas furnaces, they actually
18 calculate the impacts of product switching.

19 So obviously we'll spend a lot of time
20 on that, on those worksheets because everything is
21 going on there all at once. And there's some
22 other inputs. And so, we'll spend a little bit --

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1 probably less time on the inputs, data worksheets
2 as they're called. But those are important as
3 well. They have the data, some of the data that's
4 being used. Once again, worksheet description.
5 This is for you to have and to take a look at to
6 kind of compare what each worksheet does.

7 So again, this is the summary worksheet.
8 It's very similar to the LCC, how it's set up.
9 You have a results area. You have instructions
10 here at the bottom. And there are two things
11 going on here. First, there's some analysis
12 parameters just to see what those are. And these
13 are -- you can't really change these in the
14 spreadsheet but at least it will show you what
15 they are.

16 So for example, for this rulemaking,
17 it's the standard takes in effect 2021. The
18 analysis period is 30 years, so the end of the
19 analysis period is 2050. There are two discount
20 rates that are being used, 3 percent and 7 percent
21 and the present value is 2014. Now, there's
22 another part where you can actually change some of

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1 the assumptions and this is in this which is
2 labeled scenarios.

3 So for example, similar to LCC, you can
4 change the energy price economic variables, which
5 we call economic growth. And this is -- we use
6 some data from AEO and you can change either
7 reference in two scenarios, the trend and the fuel
8 switch. Those are the primary. So fuel switching
9 again is very specific to furnaces. It's not in
10 all products.

11 I just wanted to point out that in here
12 then you have this button which actually generates
13 a final result. So in case you wanted to change
14 some of this and you wanted to generate the
15 results you click here and it will change the
16 results at the end, a couple minutes usually it'll
17 take to run through it. So they will spend a lot
18 of time on this worksheet, which is the non-
19 weatherized gas furnace worksheet and it has a lot
20 of different spaces. It's calculating shipments.
21 It's calculating a lot of these inputs and
22 processing and also for non-weatherized gas

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1 furnaces, doing the fuel switching.

2 So obviously, this doesn't have the
3 whole thing. But just to give you a little bit of
4 background. So basically this part over here is
5 getting data from other worksheets and has -- so
6 the data input. And this side, on the right side,
7 we're actually calculating, doing all those
8 calculations, doing the base case calculations,
9 the standard case calculation and the product
10 switching. And we'll spend a lot of time on that.

11 The thing that I wanted to just remind
12 you again is that when you're looking at this
13 spreadsheet, which might be confusing when you
14 open it up, is that the results that you're
15 looking at there are for a specific region and
16 it's very, very small here. And we should look at
17 it more closely when we open up the spreadsheet.
18 This one is actually for the northern region and a
19 specific sector. For example, in this case,
20 residential. If you wanted to see the results,
21 then you would have to change the inputs to see
22 just the south, maybe you want to just look at

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1 commercial or something like that.

2 So that's important. When you generate
3 the final results, obviously it goes through all
4 these and it generates the final results.

5 MS. JACOBS: This is Diane Jacobs from
6 Rheem. So in the first spreadsheet, you're doing
7 the 10,000 households and all that. And so,
8 you're just segregating the data that you've input
9 into this second spreadsheet.

10 MR. FRANCO: Correct, yes.

11 MS. JACOBS: Okay, so it's input. Okay.

12 MR. FRANCO: Correct, correct. Yes, and
13 we'll go through that a little bit more carefully,
14 how that's set up.

15 MR. CYMBALSKY: This is John from DOE.
16 Just to clarify the difference in the spreadsheets
17 and maybe frame it up a little differently. The
18 life cycle cost spreadsheet is what would this
19 standard do to an individual customer, right? So
20 that's the sample of one. Then we know that
21 that's not representative. So we throw it through
22 the Crystal Ball. It does the 10,000 Monte Carlo

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1 simulation. So now we have all of that.

2 So then in the second spreadsheet, what
3 we're trying to do is say, okay, what does it mean
4 to the whole nation. And so, I think if you think
5 of it that way, maybe it'll help logically
6 delineate where certain things are happening, so
7 if that's helpful.

8 MS. JACOBS: Yeah, I think sometimes,
9 like what's the input, what's the output, you
10 know, can be confusing about -- yeah, just those
11 two things because you can see things. And I know
12 I've been in the NIA and trying to change the
13 input. But it really came out of this other
14 spreadsheet. So to someone who's used to working
15 with it, that must be completely illogical. But
16 it's not always clear. But from the labels,
17 you're kind of guessing what the things are. So
18 okay, thanks.

19 MR. FRANCO: Victor Franco. So again,
20 as we go through these spreadsheets, please, yeah,
21 stop me if you have additional questions in that
22 area. We'll try to make it as clear as possible,

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1 the inputs, how the inputs kind of work so you can
2 kind of get a sense if you wanted to kind of
3 visualize how that maybe would change or maybe
4 what happens. But we'll go through it individual.

5 MS. JACOBS: So just -- this is Diane
6 Jacobs from Rheem. So just in my experience, you
7 know, we're going through the technical support
8 data document and maybe we disagree with some of
9 the assumptions. But I don't want to complain
10 about every single thing. So I was trying to use
11 the spreadsheets to see if it would make any
12 difference. Was it worth bringing up, you know?
13 So it seemed like it would be easy to do but it
14 didn't end up being that easy.

15 But so I guess that's the way I would
16 use it. I don't necessarily only want to see how
17 you did it or the results of yours but to be able
18 to change some of the assumptions and understand
19 whether it's worth making an argument or not. You
20 know, there are a lot of assumptions. Some of
21 them, you know, I may or may not have ever thought
22 about. And it's not really clear which battle go

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1 to after, you know? So okay.

2 MR. FRANCO: Great, thank you. Victor
3 Franco. So yeah, we'll try to make that clear as
4 we go through.

5 MS. JACOBS: Thank you.

6 MR. FRANCO: Yes?

7 MR. MASSARO: Victor, this is Tom from
8 New Jersey Natural.

9 MR. FRANCO: Sure.

10 MR. MASSARO: Kind of along those same
11 lines, it could still be helpful to see -- go back
12 to like an incremental cost of the different
13 appliances versus what we see with our contractor
14 base versus what's in the model. If changing that
15 does have like a demonstrable difference, on the
16 output, is that something that we would get into
17 today that we'd be able to get in there and say,
18 well, if you change the installed cost of this
19 specific appliance to x, this is what the output
20 ends up looking like?

21 Is that -- is that something we would be
22 able to get into today?

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1 MR. FRANCO: Victor Franco. So we'll
2 obviously open up that worksheet once we get into
3 that worksheet, we can take a look and we'll see
4 if, yeah, if that's appropriate.

5 MR. CYMBALSKY: Yeah, well the purpose
6 here is to show you how to do that, right, and
7 we'll point you to that spot. We are not going to
8 sit here and run simulations for everybody, just
9 to be clear. Okay. We're teaching you how to
10 fish, not frying it for you. It is a Friday fish
11 day for some of us I guess, so.

12 MR. FRANCO: So this is the very last
13 slide and this is just -- this is to show you what
14 the topics I'm going to be going through. So LCC
15 spreadsheet, there's a lot more to talk about.
16 And we'll be first talking about the summary
17 worksheet, LCC calculation engine, the building
18 sample, the total installed cost, so customer
19 prices -- consumer prices, installation cost
20 model. Then we'll go into operating costs and
21 maintenance repair costs, energy use, energy
22 prices and trends. Then we'll go into other

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1 components such base case efficiency distribution
2 discount rates, lifetime and product switching.
3 So product switching again is very specific.
4 Almost everything else is very general and all
5 products will have that.

6 In terms of the NIA spreadsheet,
7 basically we'll be calculating -- we'll be looking
8 at -- focused on summary worksheet, which we kind
9 of already talked about and then the calculation
10 engine, which will have three main components:
11 inputs, the shipments and the product switching.

12 So I'll begin to talk about the LCC
13 spreadsheet. And as we go through, please stop me
14 if you have any questions. So we'll go through
15 here and let me close -- oh, I'll keep it open in
16 case we want to see something. One more thing,
17 obviously the spreadsheet view, in case you can't
18 see something I'm talking about, please let me
19 know so I can enlarge it.

20 When you open up the spreadsheet, one of
21 the first things obviously is you want to look at
22 the summary, what are the results. And this is

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1 the sheet that we've been talking about, the
2 summary worksheet. So again, once again, we're
3 looking at the user inputs which are these.
4 There's a button right here which if you press it
5 and you have Crystal Ball, everything's set up
6 properly. You can actually run the spreadsheet
7 and generate new results. And then there's some
8 instructions how to do that.

9 And then, here on the side are the
10 results that we usually have when we're generating
11 the final results. They're usually like install
12 price, lifetime operating cost, first-year
13 operating cost, LCC, LCC savings and net impact,
14 no impact. These fractions over here --

15 MS. JACOBS: Victor?

16 MR. FRANCO: And paybacks.

17 MS. JACOBS: So it says average life
18 cycle. Do you do like the 10,000 samples and
19 average or is it some kind of weighted average or
20 --

21 MR. FRANCO: Yes, this is what we're
22 going to be talking about, the specifics. Victor

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1 Franco.

2 MS. JACOBS: Okay.

3 MR. FRANCO: So we'll be talking about
4 that, where these numbers are being pulled out and
5 all that and that's very important.

6 MR. ADROIT: Victor, just a question.
7 Henri Adroit with Goodman. So you can only run
8 the spreadsheet, this particular one if you have
9 the Crystal Ball, right? Otherwise it gives you
10 an error?

11 MR. FRANCO: That's correct, yes.

12 MR. ADROIT: Okay.

13 UNIDENTIFIED FEMALE: Is it expensive?

14 MR. CYMBALSKY: How much was your flight
15 here? We'll do a quick payback analysis on your
16 flight --

17 UNIDENTIFIED FEMALE: It cost \$400
18 actually to stay today.

19 MR. CYMBALSKY: You are getting a great
20 deal. You don't know how much he bills that.

21 MR. FRANCO: So again, these are the
22 results. Just very briefly, these are the

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1 national results and we try to label it so it's
2 easy to navigate. Then these are the results just
3 for the northern region. Down here, we have the
4 results for the south. Then we have some stand-by
5 results for this product. Now, on the side -- and
6 this is -- this is very, again, very specific to
7 furnaces. We have provided disaggregated results.

8 So for example, we have the results just
9 for replacements, for residential market and then
10 below that, the north replacement residential,
11 south replacement residential and then so on. New
12 construction, and then even commercial. So --

13 MR. CYMBALSKY: So this is the results
14 summary, right? So this is not where you would
15 start changing those costs, just to be clear.
16 We'll show you where to do that. This is where
17 you would actually run the scenario and see the
18 results.

19 MR. FRANCO: Right.

20 MR. CYMBALSKY: Diane?

21 MS. JACOBS: So Diane Jacobs from Rheem.

22 Again, is it the average or is it a weighted

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1 average based on population? It's just flat
2 average?

3 MR. FRANCO: We'll go -- we'll go into
4 that detail right --

5 MS. JACOBS: Could you give me a hint?

6 MR. FRANCO: It's the average of the
7 10,000 -- the 10,000 runs. So for example, you
8 calculate one household and then that gets saved
9 in the process and then you can calculate the next
10 household, the next household and we'll go into
11 what the weighting --

12 MS. JACOBS: So is the sample somehow
13 related to population?

14 MR. FRANCO: Of course, yes, and that's
15 very important.

16 MS. JACOBS: Okay.

17 MR. FRANCO: And we'll get that when
18 we're talking about the building sample.

19 MS. JACOBS: Okay.

20 MS. ARMSTRONG: Okay, so can I answer?
21 My translation is it is a simple average but the
22 weighting comes in because your distribution that

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1 you pick up in that 10,000 is dispersed depending
2 on the weighting of the actual residences that
3 you're trying to pick up. So the results are a
4 weighted average even though it's a simple average
5 of the 10,000 runs. Does that make sense?

6 MR. FRANCO: Thank you for --

7 MR. STANONIK: Frank Stanonik.

8 Actually, let me try and flip -- let me try and
9 flip that around to make sure I just understood
10 that. So for the 10,000 runs on the national
11 average, you'd have a certain distribution of I'll
12 say simulations, data sets, right? For the 10,000
13 runs of either the north or south, it would be a
14 different group of -- yes, because now -- because
15 now, this 10,000 runs is 10,000 runs in a north
16 installation. So it does -- okay.

17 MR. FRANCO: Thank you for that. So
18 basically, let's go -- let's go to -- let me see.
19 One thing to point out, obviously something that's
20 a little bit different from other products is we
21 have commercial and we have a residential market.
22 And for this product we have a little bit of a

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1 commercial market and that's why we have those
2 results.

3 MR. CYMBALSKY: But they are residential
4 -- they meet the statutory definition of a
5 residential furnace, so just to be clear.

6 MR. FRANCO: Another part of the
7 spreadsheet that's kind of like the general
8 results are the statistics and the LCC outputs.
9 So I'll go through those two worksheets. But
10 first of all, if I click on one of these, and
11 hopefully you can kind of see that for example I'm
12 clicking on K7. You'll notice that that's linked
13 to a worksheet that's called forecast cells and
14 that's a specific cell.

15 Let's go to the forecast cells. So the
16 forecast cells are kind of the output that comes
17 out of the spreadsheet. And for this case, let's
18 go to one that is interesting --

19 MS. JACOBS: (Off mic.)

20 MR. FRANCO: Of the spreadsheet, of the
21 runs. So once you decided that you want to do a
22 run, you click run. The spreadsheet runs and then

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1 goes through and generates these statistics. The
2 statistics, which is really hard here because it's
3 not really formatted nicely, this is kind of like
4 the raw output -- is the number of trials that
5 this represents, the results they are being, and
6 the mean, median, min/maximum, 5 percent out or 25
7 percent out, so on.

8 And these actually -- all these are
9 nicely formatted in the statistics worksheet,
10 which we'll go to.

11 MS. JACOBS: So what does it mean if
12 everything is a one?

13 MR. CYMBALSKY: Can you use --

14 MS. JACOBS: Sorry, Diane Jacobs.
15 Everything is a one. Is that just because you
16 haven't run it?

17 MR. FRANCO: No. It depends on what
18 statistic we're trying to look at. But let's
19 focus --

20 MS. JACOBS: Oh, it's a flag.

21 MR. FRANCO: yeah, sometimes it's just a
22 flag, a one and a zero and sometimes it's just one

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1 household. So it depends on what you're looking
2 at.

3 MS. JACOBS: Oh, okay.

4 MR. FRANCO: So for example, you're
5 looking at specific discount rate and then there's
6 an actual value that you're getting. And so, for
7 example, here you're getting 4.7 is the average of
8 all the discount rates that you're doing but you
9 also have different statistics. So some households
10 have really small discount rates, some have -- and
11 so like you can kind of visualize a distribution
12 of that and we'll go into it.

13 So everything that's in that summary
14 worksheet, everything that's going to be in the
15 statistics and everything that goes into the LCC
16 outputs comes from here. So it's very important.
17 So that's from the 10,000 run. So let's go back
18 to the statistics so that'll be a nicer format.

19 So for example, if you wanted to look at
20 the LCC savings, what would be the maximum, what
21 percentiles, how the distribution, you would go
22 here. You could also look at the annual fuel use

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1 and the maximum, minimum and percentiles. And you
2 can kind of see the distribution. This helps you
3 out to visualize a little bit of what's going on
4 in the spreadsheet. And we've provided what we
5 think is the primary inputs and information that
6 would be useful.

7 We even go to kind of some economic
8 variables, installation location and some energy
9 variables that are important like operating hours,
10 calculated fuel use and some inputs. And so, you
11 can kind of play around and see what everything.
12 But this is again coming from that 10,000 run, all
13 the households that are looked at.

14 MR. MASSARO: Victor, quick question on
15 that. You were mentioning that this is where you
16 can -- is this -- oh, Tom Massaro, New Jersey
17 Natural Gas. Is this where you would go in and
18 change that?

19 MR. FRANCO: No.

20 MR. MASSARO: No, I didn't think so
21 because I still saw the equal sign. All right.

22 MR. FRANCO: Everything we're looking at

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1 is the final result, still coming up and then
2 we'll go into where you can actually change it.

3 MR. SCHROEDER: Is there a way you can
4 get - - oh, sorry. Dave Schroeder. Is there a
5 way you can get the complete output? So if you
6 wanted to see like the complete distribution of a
7 particular cost or a particular energy
8 consumption, is there a way you can get that
9 complete distribution for the entire 10,000?

10 MR. FRANCO: Yes, yes, there is. It's
11 not built into the macro, as you -- I'll probably
12 describe it in just a couple steps.

13 MR. SCHROEDER: Okay, that's fine.

14 MR. FRANCO: But that's a good question.
15 I wasn't sure if we wanted to go into that. But
16 I'll actually go into that detail to show you more
17 or less how you would do that using Crystal Ball.
18 So if you don't have Crystal Ball, obviously you
19 wouldn't be able to do it. So just briefly --

20 MR. M. HUNT: Excuse me, this is
21 Marshall Hunt with PG&E. The Crystal Ball I found
22 on the Web was \$1,000. Such a deal.

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1 MR. CYMBALSKY: Less than a life cycle
2 cost of a furnace in the north.

3 UNIDENTIFIED MALE: You can buy a magic
4 eight ball for \$8.99.

5 MS. JACOBS: It'll only cost \$50,000 to
6 learn how to use it.

7 MR. FRANCO: So just one additional
8 worksheet that I wanted to show you and it's in
9 this realm of final results that is important and
10 we need to talk about it because this is a major
11 input to the NIA is the LCC outputs. This will
12 talk about more detail. This goes into the NIA
13 spreadsheet. And again, this is the results of
14 the 10,000 running the spreadsheet 10,000 times.

15 So now, we'll be more focused on looking
16 at the worksheets and the individual household
17 calculations when we're going to households.

18 MR. CYMBALSKY: So I think now we'll
19 turn to the inputs and I think let's just start
20 with the cost of furnaces and go from there. Does
21 that sound -- it sounds like I'm picking up a vibe
22 that that's where people want to start.

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1 MR. FRANCO: There's just one worksheet
2 just before that and then we'll go right into it.

3 MR. CYMBALSKY: Okay, great.

4 MR. MILLER: Victor, just quickly, just
5 go back one. The percentiles --

6 MR. FRANCO: Yes.

7 MR. MILLER: Okay, so what are you
8 telling - - what is that telling us? So the 5
9 percentile of all population would have a negative
10 life cycle? I'm trying to figure out. It can't
11 be cumulative, right? Explain to me what I'm
12 seeing there.

13 MR. FRANCO: Yes, yes, and that's very
14 important. And you kind of think about it. I
15 don't know if you have kids sometimes, they take
16 the standardized tests and they're saying, oh,
17 your kid is in the 95th percentile, or if he might
18 not be a good student, he's in the 5th percentile
19 or something like that.

20 So in that kind of -- if you're thinking
21 about that, if your child was in the 5th
22 percentile, he would be exactly at this 750.7

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1 negative dollars. So obviously there's -- below 5
2 percent there's people that are actually worse
3 than that and that gets into this minimum. This
4 would be the minimum. Then you have some people
5 that just don't have anything and then you go into
6 the other range and 95th percentile then goes into
7 the other direction. And so, that at exactly,
8 95th, 1,900, but then there's people that actually
9 save more and then you get to this 25,000.

10 MS. JACOBS: And then Diane Jacobs from
11 Rheem, and because it's life cycle cost savings, a
12 negative means it's costing 5 percent --
13 percentile more, though they're paying more.

14 MR. FRANCO: Correct.

15 MR. CYMBALSKY: So 5 percent is just the
16 -- that's the percentage of the

17 MS. JACOBS: No, that small segment of
18 the population --

19 MR. CYMBALSKY: Yeah.

20 MS. JACOBS: Has to pay more.

21 MR. CYMBALSKY: Right, 11,000 or more.

22 So the first 5 percent losers let's call them,

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1 they save -- they lose as much as 11,000 I thought
2 I saw, yeah, 11,732. So that's the guy who lost
3 the most.

4 MS. ARMSTRONG: That's the min.

5 MS. JACOBS: Oh, wow.

6 MR. CYMBALSKY: So he never used -- he
7 bought a furnace and never used it.

8 MS. JACOBS: Oh, okay.

9 MR. CYMBALSKY: That's actually --
10 that's what that means.

11 MS. JACOBS: There are those people.
12 Okay, thank you.

13 MR. FRANCO: And obviously what we're --
14 what we're looking at the summary, we're looking
15 at the average, which is this value here and this
16 matches the summary. But if you want to look at
17 it in more detail, this is why we provide this so
18 you can kind of like get a sense of the
19 distribution.

20 So let me briefly go to the main
21 calculation spreadsheet. The main calculation
22 spreadsheet is where all the calculations are

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1 going to end up. All the inputs from anything
2 that's being done in the spreadsheet comes here.
3 And so, for example, we'll talk about retail
4 prices. So for example, the cell R6, we'll go
5 into the retail price worksheet and we'll look at
6 how those are inputted in there. But this is the
7 output from there that goes in here. Installation
8 cost, that's where this is being calculated.

9 UNIDENTIFIED MALE: The calculations.

10 MR. FRANCO: The calculations, yes. At
11 the far right of all this are the actual
12 calculations of the annualized calculations that
13 are going on. So first, you would calculate the
14 total installed cost. So that would be your first
15 cost and then every year you're calculating
16 basically your operating costs. But that might be
17 some maintenance, other costs that are associated.
18 So you can actually see here year by year what's
19 going into that household. And it varies.
20 Obviously the energy price varies. And that's why
21 this is varying and then you have maintenance
22 costs that are being generated there.

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1 Everything else are inputs to that. The
2 final thing to look at here are the results. So
3 when you look at and you're comparing for example,
4 well, what's going on here at LCC savings or even
5 LCC. So for this individual household, you're
6 just looking at that LCC savings for that
7 household. And depending on the economics of the
8 household, that's the result that you're getting,
9 just one household.

10 The final thing to -- what I wanted to
11 talk about this spreadsheet, this worksheet is
12 there's two things to note related to Crystal
13 Ball. When you see a green cell like this,
14 that'll mean that it's a distribution. And we'll
15 open it up and see what that means. When you see
16 a blue, that means that it's a forecast cell. So
17 let's cite that into the idea of forecast cell
18 worksheet. So what happens is if we set this up
19 as to be a forecast cell, then every time that a
20 household is being calculated, this value is being
21 recorded. And then as it's processed, the final
22 result is an average. Going back to the question

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1 -- what was your --

2 MR. SCHROEDER: Dave Schroeder.

3 MR. FRANCO: Dave Schroeder had, we
4 would -- once we run the spreadsheet, so this is
5 again -- this is more of a detail obviously. If
6 you have Crystal Ball and you run the spreadsheet,
7 what you're able to do is extract all that data.
8 So what you want to do is you run the spreadsheet.
9 Then you go to the Crystal Ball. If you have
10 Crystal Ball, you actually have this tab called
11 Crystal Ball. And what you can do is once you run
12 it, you actually -- there's a button that --
13 because we haven't run the spreadsheet.

14 It's not live. But once you run it,
15 it's active, which is called and hopefully you can
16 see it, which is called extra extract data. Once
17 you click on that, actually gives you what you
18 want to extract. So you might want to just
19 extract one variable or, sorry, one forecast cell.
20 And that'll be it and that'll be the whole 10,000
21 and actually you can do statistics also. You can
22 actually just the raw data or the statistics or

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1 you can do all the variables. Now, there's so many
2 variables that depending on sometimes it doesn't
3 fit in one worksheet. So sometimes you want to
4 minimize and it also takes more time to extract
5 obviously. So that's that and hopefully that
6 clarifies that and that's more of a detail.

7 Let me just go in here. For example,
8 here we have a green. If you have Crystal Ball,
9 you can see what the distribution of this is in
10 Crystal Ball. So here, you wouldn't be able to
11 tell what's going on there. It's just a green
12 cell. There's no formula. There's nothing. So
13 you would actually -- I click on here which says
14 define assumption. And you click on it and it'll
15 actually give you what that assumption is. All
16 right, it might take a while because it's looking
17 at it. Hopefully it'll open up.

18 MR. CYMBALSKY: So while this does it's
19 thing, Richard Murphy had a question. Are there a
20 different set of assumptions, variables for
21 replacement and new and the answer is yes. I
22 think Victor has been detailing that breakout in

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1 the spreadsheets and we'll see more of that as we
2 go through. Another question from David Nestor.
3 What size house is being used as the input and
4 what is the average age of the house. I think
5 this comes from the RECS database.

6 So each one of those houses has
7 different characteristics. Age is one of them.
8 Size is another one. And that goes to sampling
9 and then goes into the Crystal Ball and gets a
10 distribution, et cetera.

11 MR. FRANCO: And Victor Franco again.
12 We'll go into that once we get into building
13 sample. So this is how the distribution actually
14 looks for this particular variable. And this is
15 the probability that that will be the
16 distribution. Obviously this will get more of a
17 probability that this will be selected versus
18 these other two.

19 So this is kind of the weighting, the
20 probability of that. And actually this is another
21 detail. In Crystal Ball you can actually see
22 statistics and percentiles and other things that

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1 are in terms of distribution. Once we get to
2 distribution, it's a little bit more interesting.
3 We'll actually open that up and we'll see how that
4 functions. So hopefully that clears up the flow.

5 So this is what we can call the
6 calculation engine and we might need to go back to
7 this. So now let's go to the actual input
8 worksheets. And let's start as we were saying
9 we're going to be starting with the equipment
10 prices, the one that calculates the consumer
11 prices. Okay. So basically the consumer prices
12 are the manufactured costs times markups which
13 will also include sales taxes. Now obviously
14 there's a lot of other inputs that go into it.

15 For this, it depends also for example on
16 the furnace fan type and if it's for example in
17 California that it's being shipped, then we
18 consider that it's a fraction of time it'll be a
19 low NOX unit. So there's very specific variables.
20 And so, there's where you get into the details of
21 what product you're dealing with. But in general,
22 the methodology is you have a manufacturer cost

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1 and you multiply that times markup and sales
2 taxes. Also, you have a shipment cost as well
3 associated with that.

4 So let's briefly go over the worksheet.
5 Again, almost all these worksheets will have the
6 same setup. We have input parameters. We have
7 data down here. So this is the engineering data
8 that gives us the manufactured production cost and
9 then we actually go into the calculations.

10 Another thing that I just want to -- I
11 forgot to mention is the first part of the
12 presentation, I want to focus just on the general
13 results that are without the product switching.
14 As we discuss the product switching, then we will
15 have to go back to some of these worksheets, which
16 there are certain components that are related to
17 product switching and you might have questions on.
18 So we'll go into those. But just to have the
19 flow.

20 MR. MILLER: Victor, could you just
21 slide back to the -- my left, yeah. Learning
22 rate, is that what that says?

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1 MR. FRANCO: Yes.

2 MR. MILLER: What is the learning rate
3 factor?

4 MR. FRANCO: So this is the equipment
5 price but we'll talk about that and it's
6 essentially over time equipment prices change, and
7 so this is supposed to take that into account.

8 MS. JACOBS: Diane Jacobs from Rheem.
9 So you have references to X13 and ECM. Is that
10 for the standby? It was going to the side?

11 MR. FRANCO: These would be, yeah.

12 MS. JACOBS: Okay.

13 MR. FRANCO: These would be down here.
14 This is for the actual furnace motor that's being
15 used for the furnaces.

16 MS. JACOBS: Yeah, but that's part of a
17 furnace fan, so --

18 MR. FRANCO: Yes, that's correct. But
19 we have to -- since there is a furnace fan rule,
20 that's going to be before 2021, then we take that
21 into account. So for example, if we were just
22 analyzing today, we would have certain fans for

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1 furnaces which have PSC motors and some fraction
2 that have ECM or X13. By 2021, the assumption is
3 that everything will be X13 and ECM because of the
4 furnace fan standard. So that's why we were
5 considering.

6 MS. JACOBS: But for furnace -- the
7 furnace rule, you're talking about AFUE, aren't
8 you?

9 MR. FRANCO: That's correct, yes. But
10 those --

11 MS. JACOBS: So that's only gas
12 consumption.

13 MR. FRANCO: That's correct.

14 MS. JACOBS: So why are you --

15 MR. CYMBALSKY: Well, what do you do
16 when you buy a furnace, brand new?

17 MS. JACOBS: What do I do? I don't buy
18 them. I get them. (Laughter.)

19 MR. CYMBALSKY: You know, and in the
20 government, we don't get free money because we
21 print it.

22 MS. JACOBS: So --

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1 MR. CYMBALSKY: Sign me up. I'm in.

2 It's the cost of a furnace, right?

3 MS. JACOBS: Oh, the cost is related to
4 the fan. Okay.

5 MR. FRANCO: Yes, yes.

6 MS. JACOBS: The first-time cost.

7 MR. CYMBALSKY: Right.

8 MS. JACOBS: Okay.

9 MR. CYMBALSKY: So you can buy up on the
10 fan.

11 MS. JACOBS: Okay, okay.

12 MR. CYMBALSKY: Yeah.

13 MS. JACOBS: Thank you.

14 MR. FRANCO: So, correct. Yes, of
15 course.

16 MR. ADROIT: Henri Adroit, Goodman.
17 More of a suggestion than a question. Would it be
18 possible I guess when you release this again in
19 the NOPR stage to highlight input cells that
20 stakeholders have an option to play around with,
21 assuming that they have Crystal Ball, but just
22 similar to how you did the green and blue shading,

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1 just to be able to highlight the input cells as
2 well that we would have control over?

3 MR. FRANCO: That's really good --
4 Victor Franco. That's a good suggestion.
5 Definitely we'll take that into account. Thank
6 you.

7 MR. CYMBALSKY: Yeah, normally we lock
8 the cells that you shouldn't change. That's how
9 we do it.

10 MR. FRANCO: So that's sometimes a
11 little bit difficult. You want to know everything
12 that goes into that assumption and then to be able
13 to change the variables and usually the
14 documentation will have that kind of detail to
15 kind of walk you through what kind of the
16 assumptions and then how to generate those
17 assumptions. But that's a really good suggestion.
18 Thank you for that.

19 MR. LESLIE: Neil Leslie -- excuse me.
20 Neil Leslie, GTI. You said that you lock cells
21 that you don't want people to change.

22 MR. CYMBALSKY: Right.

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1 MR. LESLIE: Could you elaborate just a
2 little bit on --

3 MR. CYMBALSKY: So for example, if
4 there's a calculation that takes the number of
5 days of the year into it, we won't let you make it
6 anything but 365. So, an example. You can change
7 that number. You will break the model. Just so
8 that you know my background, for 20 years I wrote
9 the EIA NEMS residential model and it's the same
10 thing there. You protect certain input variables
11 from outside users who purchase and use the model
12 from breaking it. The only way we can do that is
13 by locking cells.

14 So can they be unlocked? They can, but
15 it's not of any value to do so. You'll just have
16 users break the model and then have more questions
17 that shouldn't arise.

18 MR. MILLER: John, Bud Miller. It's on.
19 Can we get a list of the locked cells? In other
20 words, what it is that's being locked? You gave
21 an example and that's nice. But can we get a list
22 of those?

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1 MR. FRANCO: Victor Franco. So in this
2 spreadsheet, actually there isn't any specific
3 that's being locked. But what happens is that you
4 have these if statements and there is some logic
5 in that that if you kind of break it -- like John
6 is suggesting, like if you don't have a maximum of
7 365, then it kind of doesn't make -- the result
8 doesn't make sense. And that's a good suggestion
9 to actually put that as a list of what those
10 variables are and what those -- yeah. Thank you.

11 MR. CYMBALSKY: My experience, you know,
12 from my previous employment is that I'd say 99
13 percent of the users who wanted to use a model
14 broke it, not intentionally but unless you protect
15 from going out of the bounds of what the model can
16 and can't do, you have to protect it somehow. And
17 I'm sure Excel and other spreadsheets and programs
18 have that as well. Please come up to the mic. I
19 think you'll have to switch the button on.

20 MR. SORINO: Don Sorino, National
21 Association of Home Builders. The cells that are
22 locked, you know, I had heard the question can we

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1 know which ones they are. Could we also know what
2 their parameters are?

3 MR. FRANCO: Yeah, so just to emphasize,
4 in this current spreadsheet, there is actually no
5 cells that are locked and you can't like change.
6 But to emphasize, if you do some -- make some
7 changes and maybe you don't understand what things
8 are doing, you will break the model. It will
9 produce results that might not make sense, but --

10 MR. SORINO: Understood.

11 MR. FRANCO: Yeah.

12 MR. SORINO: But if there are locked
13 cells in any of the sheets, understood we
14 shouldn't unlock them. You had them locked for a
15 reason.

16 MR. FRANCO: Correct.

17 MR. SORINO: But to know what those
18 cells are and to know what they're locked at would
19 be helpful information.

20 MR. FRANCO: Great. Thank you so much.
21 I appreciate that.

22 MR. SORINO: Thank you.

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1 MR. CYMBALSKY: It's in the
2 documentation.

3 MS. ARMSTRONG: Yeah, so I mean,
4 typically - - this is Ashley from DOE. So while
5 Victor's saying that there's no specific locked
6 cells in the LCC spreadsheet, the furnace one that
7 he's using for an example, there are sometimes
8 locked cells in other spreadsheets. And I know
9 for example in one of them, questions have some up
10 recently.

11 There is documentation in there about
12 what cells are locked and why. And specifically,
13 it says like this cell is locked. It's an
14 implementation equation and it shows the equation
15 written out on a worksheet in the spreadsheet
16 itself. So I would encourage you to look at it
17 first and see if you can - - because you can see
18 the equation being implemented but it's just
19 locked. It can't be changed.

20 But you can actually see the equation.
21 And then on a separate tab, it has the equation
22 written out as well as in the TSD. So you can

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1 follow it all. It's just that if you change that
2 equation, it's then -- it's not an implementation
3 of our test procedure. It's not an implementation
4 of an accurate model. It's not the DOE model and
5 it will not give you any type of meaningful
6 result. So it's not helpful. Okay?

7 MR. FRANCO: Thank you for that. So
8 just to highlight some of the -- and if as a user,
9 this is part of the complexity -- some of these
10 have a lot of if statements and a lot of uses of
11 Excel that are maybe not usual. They're a little
12 bit more complicated, so using, for example, match
13 function or index to generate these. So if you
14 are an advanced user of Excel, you will more or
15 less be able to navigate these. But we understand
16 that these are hard to do.

17 So just to highlight the questions about
18 where you would so some of the changes, so for
19 example, let's say for example you wanted to
20 change the manufacturer production cost. So for
21 example, this column right here is picking up the
22 appropriate manufacturer production costs that are

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1 related for that household. For furnaces, it
2 actually picks up other components as we talked
3 about. It picks up what the furnace fan that
4 household will have and, for example, if it's in a
5 region, California, it will have a low NOX add.
6 So that's part of that specific cell. So if you
7 wanted to change that, then you could be able to
8 change it there to change specific.

9 MR. CYMBALSKY: But to be clear, if you
10 don't care about all that other stuff, let's just
11 say, Neil, for example doesn't believe it's 381,
12 it's 500, we can just change it right here and it
13 will flow through.

14 MR. FRANCO: Yeah.

15 MR. CYMBALSKY: So this is an
16 appropriate spot to overwrite the number. Now it's
17 going to ignore all that other stuff. So you want
18 to simplify this? You could just say, I think it's
19 500, I think that one's 600, et cetera, et cetera.

20 MR. FRANCO: Exactly. And so, this is
21 the basic -- the first place that you could do
22 that because that's the manufacturer cost. Then

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1 you actually multiply it times markups. So
2 there's an additional place that you might be able
3 to do that. Now, going backwards, if you didn't
4 want to go that far but you wanted to change kind
5 of like the primary manufacturing cost, the inputs
6 are here.

7 Say, for example, these are fixed
8 values. This is data coming from the engineering
9 analysis. You say, well, what if increase this
10 incremental 10 percent. So here you can actually
11 go, oh, I'll just increase this by 10 percent, 10
12 percent or 15 percent. And then you can actually
13 change it there. These are fixed values. You
14 generate your results based on that and you have
15 to have an understanding of what you're trying to
16 do. Obviously this is manufacturing cost at 10
17 percent there, means something else in the final
18 consumer price. It's not going to be 10 percent.

19 Now, in the final result that comes from
20 this is the retail price and that's related to the
21 markups, which will go to a different worksheet.
22 The retail price is another place that you could

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1 actually have some type of a percentage. So say
2 you wanted to have a fixed 10 percent increase for
3 one of these levels. You thought this is 10
4 percent more. Then here you can actually just 10
5 percent, put in that cell.

6 MR. CYMBALSKY: And so, to get to Frank
7 Stanonik's question about the learning, so you can
8 see it comes in here. If you go back to the
9 learning where it said 0.94, if you just changed
10 it to one, you would zero out the learning. I
11 know that's another thing that people want to
12 know. So the 0.94 I think represents there's a 6
13 percent decline in the price of furnaces.

14 MR. FRANCO: Correct, and we'll go into
15 that in a little bit more detail because we're
16 going to two worksheets really quickly that are
17 related to this. And so, once you kind of
18 visualize that these are kind of the calculations,
19 the next part is kind of some of the inputs. So
20 the two inputs that we looked at are markups and
21 equipment price trends.

22 So there's a markups worksheet that I

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1 kind of started with when I was doing the slides.
2 It's a very similar setup. You have some input
3 parameters, the markups calculation and then
4 intermediate calculations we kind of already
5 discussed.

6 In this sheet, for example, for this
7 specific building, it's in region ID 5, and so
8 what it's doing, it's looking the individual
9 results for that region. Once that picks up
10 what's appropriate for that household, it'll go
11 down here and calculate what are the markups that
12 are going to be applied for the equipment prices.

13 In this case, we have a manufacturer's
14 markup which is fixed, 134, and then we have a
15 baseline and incremental markup which includes
16 sales tax if it's appropriate. And that's what's
17 outputted into the equipment prices. And you can
18 actually go back to the equipment prices -- let's
19 just -- oops, sorry about that -- and match that
20 these two values are the right values that we saw
21 as outputs before including this manufacturer
22 markup.

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1 Now, let's talk about the industry price
2 trend or learning rate. And then, that's this
3 parameter. Now, because we have the standard
4 that's fixed at 2021 which is when we are assuming
5 that the equipment is being purchased, this value
6 is 0.937. It's a fixed value. Obviously if that
7 year changes, then it would be a different value.
8 So that's what's being picked up. Now, the user,
9 if we go back to the summary, has the option built
10 in to actually change that -- the trend. So right
11 now it's looking at a decreasing default. If you
12 put no learning, actually click on that and go
13 back to equipment price trend, it'll change what
14 the fraction will be or what's being looked up.
15 So in this case, it's looking up a different
16 value.

17 So the equipment price will have a
18 different forecast in that case and you can
19 actually hard code this value if you thought that
20 that value was different. You can actually hard
21 code it to 0.5 or I want one and you can do that
22 as well.

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1 MR. M. HUNT: And this is Marshall from
2 PG&E. So you do not need Crystal Ball for some
3 analysis this looks like if you --

4 MR. FRANCO: Well, then again, the
5 results that you will see if you don't have
6 Crystal Ball are just for individual households.

7 MR. M. HUNT: Oh, okay.

8 MR. FRANCO: Yeah, and it becomes really
9 hard because then --

10 MR. M. HUNT: Got it.

11 MR. FRANCO: We don't have an average
12 household. There's all these variables and so it
13 would be a little bit hard to you. Yeah,
14 definitely once you change this, for example, you
15 want to run it and see what happens to 10,000.

16 MR. STANONIK: So Frank Stanonik, AHRI.
17 So the information you had up above, you were
18 showing cost in MSP in 2013 dollars and then you
19 showed I think the price, right --

20 MR. FRANCO: This right here would be in
21 2013 dollars, yes.

22 MR. STANONIK: Right, and then you

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1 showed what I think was the retail price or
2 something.

3 MR. FRANCO: This is correct, the retail
4 price 2013 dollars, yes.

5 MR. STANONIK: So that's also -- that
6 amount doesn't reflect the learning factor.

7 MR. FRANCO: It does, yes.

8 MR. STANONIK: Wait, it does or doesn't?

9 MR. CYMBALSKY: It does, the 2013.

10 MR. STANONIK: It does, but you put it
11 back in the 2013 dollars.

12 MR. CYMBALSKY: Yes.

13 MR. FRANCO: Correct.

14 MR. CYMBALSKY: It's real dollars, not
15 nominal, yes.

16 MR. STANONIK: Okay, thank you.

17 MR. FRANCO: So that takes a look at the
18 equipment prices. So hopefully that's more or
19 less clear. As we go through these very similar
20 the worksheets.

21 MR. CYMBALSKY: So I think now let's
22 jump to the installation costs. It's probably

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1 where there's more questions. Neil, question?

2 MR. LESLIE: I do have a quick question
3 and it's going to get into some of the other
4 aspects of this related to the product switching.
5 And that is, where would I find the costs of the
6 heat pump and the electric furnace and the
7 electric water heater and the gas water heater
8 that are all necessarily wrapped up in that
9 impact.

10 MR. FRANCO: Yes, and obviously I
11 mentioned that we were going to go to that when we
12 go to the fuel switching. But let me just show
13 you where those are at and then we'll go back to
14 it into more detail. So some of those inputs,
15 because they're related to equipment prices, the
16 markups we're assuming they're the same, are in
17 this sheet called equipment prices. And this part
18 of the equipment prices is what we've been talking
19 about, the non-weatherized gas furnaces. Now, if
20 we go to the right, we will find the equipment
21 switching options.

22 So let me just really briefly talk about

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1 what the options are and what the different
2 components here are. So we're considering a
3 central air conditioner and this would be the
4 retail price of that, a heat pump, this would be
5 the retail price and this is for the individual
6 household. So again, if the household is located
7 in a certain region, all these other factors, this
8 is the cost. Gas water heater, electric water
9 heater and electric furnace. When we go back,
10 we'll go into more detail as to some of the
11 assumptions.

12 So it's easier to understand because we
13 have to actually see the switching price. But as
14 you have questions, please --

15 MR. LESLIE: Absolutely. This is Neil
16 Leslie again. Are there distributions of
17 efficiencies for each of those options as well?

18 MR. FRANCO: Yes, and it depends on
19 certain inputs. So let me just very briefly -- so
20 for example, we consider what the heat pump size
21 is of the equipment. So depending on what the
22 heat pump size, it will have a certain cost. So

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1 let me go down here. For example, if we're looking
2 at a heat pump and we assign a two ton, it will
3 have this as the manufacturer production cost,
4 \$900. But if it's a five ton, it will have this
5 cost.

6 MR. LESLIE: Understood. I guess my
7 question is --

8 MR. FRANCO: Sure.

9 MR. LESLIE: Is it only for a 14 SEER
10 heat pump or are there other heat pump
11 efficiencies within this that the consumer might
12 choose to switch to? Am I making sense, I hope?

13 MR. FRANCO: Yes, yes, that's a very
14 good question and I'll answer it.

15 MR. LESLIE: And so, if there is
16 information related to a more efficient heat pump,
17 this example, where in the spreadsheet would that
18 distribution be found is my question.

19 MR. FRANCO: Correct, correct. Yes.
20 Again, this is an equipment and we would go into
21 more detail, but the specific answer to that
22 question is that in this analysis we assume it's

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1 only 14 SEER. We assume that the household that's
2 being switched to, it's the minimum efficiency
3 because that's where the economics might make more
4 sense for that house.

5 MR. LESLIE: Neil Leslie again. That's
6 why I couldn't find it.

7 MR. FRANCO: Yes, yes.

8 MR. LESLIE: Thank you.

9 MR. FRANCO: Thank you. So let -- sure.

10 MR. MILLER: Bud Miller. Do you have a
11 learning curve for all that equipment, the
12 electric equipment, et cetera?

13 MR. FRANCO: Yes. Yes, so let me go and
14 show you that.

15 MR. MILLER: Okay.

16 MR. FRANCO: Yes, so for furnaces, we
17 use the furnace learning curve. For central AC
18 and heat pump, we have this central heat pump
19 learning curve which is similar values and for
20 water heaters we have its own learning curve.

21 MR. MILLER: What is it --

22 MR. FRANCO: Oh, water heater.

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1 MR. MILLER: Meaning no learning curve?

2 MR. FRANCO: That's correct, yes. And
3 some of the assumptions, years are used for those
4 inputs are here. For water heaters, it's just
5 one. There's no -- it's not changing, not a
6 variable.

7 Okay, so we're entering installation
8 costs. It's one of the more complicated
9 worksheets, probably the more complicated
10 worksheets in the spreadsheet. So bear with me as
11 we go through. There are a lot of details that
12 are very specific to furnaces. Almost all other
13 products, it's very -- there's less inputs, let me
14 put it that way and it's less complicated.

15 So to understand this, the whole what's
16 going on, you do actually need to understand the
17 furnaces and furnace market and how they're
18 installed and things like that. So as we go
19 through, obviously you'll have some questions and
20 we'll try to answer them as best we can. Now, a
21 lot of this goes back to the building sample in
22 the household that we're assigning and that will

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1 actually be the next section.

2 But let's assume that you have a
3 household that you've selected and it's in a
4 certain region and that you assume that it's a
5 replacement. So you have all these assumptions
6 there citing to that specific household. Again,
7 the setup is we have all these input variables.
8 So this is hopefully -- I'll try to make it not
9 too overwhelming but obviously this is probably a
10 lot, very overwhelming.

11 So this is the input parameters that
12 come mainly from the building sample and some
13 distributions and some information that comes from
14 other cells. But primarily for the building same.
15 For example, one of the primary things that we're
16 trying to calculate is the pipe length. To
17 calculate the pipe length, it's very complex. You
18 have to understand that it depends on the building
19 type. So what's going on is that let's say you
20 start with 80 percent or lower AFUE furnace that's
21 being installed in an old building. So what we
22 want to do is we want to try to see what's going

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1 on, what would be -- if they're trying to do
2 horizontal or if they could do some type of
3 vertical, what would be the vent length. So a lot
4 of these input variables are trying to determine
5 that.

6 One of them is, for example, the number
7 of floors in the building or household. And so,
8 that's an input that comes from RECS. RECS
9 actually tells us that this household has one
10 floor. Another input is whether that household
11 has, for example, a basement. Then obviously then
12 the furnace might be installed in the basement and
13 then you'll have one additional floor. Other
14 input variables that come from RECS are for
15 example if it has a high roof or ceiling, things
16 of that sort.

17 Let me focus on an additional one is the
18 installation location. That does not come
19 directly from RECS but there is a process that we
20 set up to try to simulate where the installation
21 location will be based on RECS variables.
22 Basically, for example, let's say that a household

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1 has a basement. Most of the time, the furnace
2 will be in the basement. So we assume that the
3 furnace is in the basement. When we do that and
4 we run this spreadsheet, we come up with similar
5 results to survey data from different sources. So
6 we assume that that's -- that that works out.

7 But RECS again does not tell us that the
8 furnace -- that's not a question in RECS. Then
9 after that, then we assume if it has an attic, a
10 certain percent of time it will be in an attic or
11 a garage, crawl space. So we have all these
12 installation locations.

13 Let me go back to the statistics. Some
14 of the -- those type of variables that are
15 important and to look at, kind of what we're
16 getting into final results, could be available
17 here. For example, this is the installation
18 location. And here, you can see the different
19 installation locations. Each one of these has
20 very specific installation costs that would be
21 associated with them and let me put this a little
22 bit larger so we can all see. This is what our

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1 assumptions is. It's basically a condition.

2 Actually RECS will tell us if it's

3 conditioned or unfinished or unconditioned, a

4 crawl space, garage, indoor, attic, if it's

5 conditioned or unconditioned. And these are

6 actually the fractions that result from running

7 this model 10,000 times. This is the national.

8 And let me just point out that the same -- you

9 could look at the north region or this is -- okay,

10 I'm not quite sure -- what I'd like to go up --

11 and the southern region.

12 So you can actually look at what those

13 are. Now, again, the question about if you wanted

14 to look at all the 10,000, you actually output

15 that and you can actually look each individual

16 household what that input for that installation

17 cost.

18 MR. MILLER: All right, this -- well,

19 this may be one of the questions I'm getting a

20 little gray area. So in the particular analysis

21 that we're using as an example here, there are

22 some percentage of installations that are in a

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1 commercial building. And in what you're just
2 showing us, I would say those were all
3 installation sites in a residential building.

4 MR. FRANCO: Correct.

5 MR. MILLER: Is there a different set of
6 -- let me call them installation options for
7 commercial buildings and I'm trying to envision
8 the CBECS, right. It's a commercial building. So
9 and is that based on what the building looks like
10 or is it still based on where in the building it
11 is for commercial because, boy, that gets really
12 squirrely.

13 MR. FRANCO: Yes, yes. And obviously
14 when you're trying to do this analysis, you are --
15 you try to visualize, right, what's going on and
16 what the input variables. And for example CBECS
17 does not actually provide where the building is,
18 like what location as well as with RECS. So what
19 we assumed is it's going to be indoors and
20 depending on the number of floors, we make some
21 number of assumptions about what would be the vent
22 length, so --

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1 MR. CYMBALSKY: SO this is John from
2 DOE. Yeah, we're getting close to over the line.
3 But let me just step back a little bit. So let's
4 just logically think this out. So some
5 residential furnaces are used in commercial
6 buildings. Why would that be? Because they're
7 probably very small buildings that actually look
8 like a house.

9 For example, a small restaurant or a
10 barbershop or something of the like that would not
11 put a residential furnace in a very complicated,
12 big office building such as this. So based on
13 that logic, I think we did an analysis and I think
14 we need to stop it at that point.

15 MR. FRANCO: That's correct, yeah.

16 MR. MILLER: Okay, thank you.

17 MR. FRANCO: So those are kind of the
18 inputs. Then obviously after you have those
19 inputs, you're making some assumptions and then
20 that's where some of the distributions are coming
21 in. So for example, one is the average ceiling
22 height. Now, we have some NHAB data that shows

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1 there's a distribution and you can actually see
2 the distribution here and fraction of the time
3 it's going to be eight feet.

4 A fraction of the time it's going to be
5 nine feet and a fraction of the time it'll be 10
6 feet. And that's based on that data almost 70
7 percent are going to be picked up as nine feet.
8 For this distribution you can actually see a
9 statistic and the mean would be 9.2 feet, the
10 average. But you're actually picking up the
11 distribution. So some households will be 10 feet.
12 Some households will be nine or eight feet.

13 MR. SCHROEDER: Can I ask a question on
14 those distributions?

15 MR. FRANCO: Sure.

16 MR. SCHROEDER: So that distribution and
17 then there are other distributions on this sheet
18 and others, do those depend on each other and do
19 they depend on some of these other inputs or are
20 they each one as a completely independent
21 variable?

22 MR. FRANCO: Victor Franco. So almost

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1 all variables in this spreadsheet, I almost want
2 to say that all of them are independent.
3 Obviously there are some dependencies that are
4 associated with them. If there's a strong
5 correlation, you can actually have a correlation
6 variable related to that. But that would require
7 more data in what would be that correlation
8 factor.

9 MR. CYMBALSKY: I do think it's safe to
10 say that in the 10,000 simulations that are run,
11 that'll be picked up. Those co-dependencies will
12 be, you know, mapped to one another and it's one
13 of the 10,000.

14 MR. FRANCO: So the distributions
15 themselves are kind of independent. But there's
16 if statements to say that this and this has to
17 match to be able to pick up a certain variable.
18 So there's some logic that tries to pick up the
19 dependencies that are obvious and then there are
20 some that might not be as obvious and you would
21 actually have to have the data to say that this
22 depends on this a certain fraction of the time

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1 with that data. What we have data on, and we have
2 fractions and we can do some if statements, we do
3 do.

4 MR. CYMBALSKY: Laura?

5 MS. PETRILLO-GROH: Laura Petrillo-Groh,
6 AHRI. I might be getting ahead or
7 misinterpreting. But does this assume that the
8 mobile home gas furnaces are all -- all have the
9 same installation?

10 MR. CYMBALSKY: Yeah, that's a different
11 meeting. Sorry. That's a good example of a
12 deliberative question.

13 MR. FRANCO: So those are the different
14 assumptions for different product classes. And
15 yeah, we're focused more right now on the non-
16 weatherized. But if you see the spreadsheets, the
17 inputs and the variables for both of them are
18 significantly different and that's based on just
19 the application. So we do look at the application
20 and we make those assumptions, yeah.

21 So obviously there's -- we then need to
22 look at whether the household is commonly vented.

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1 So if you're familiar with furnace installations,
2 some of the furnaces are commonly vented with
3 other products. Here we only assume that they're
4 commonly vented with water heaters. There might
5 be other equipment but here we're just assuming
6 gas water heaters with a gas furnace.

7 Other assumptions, for example, are
8 there's some apartment buildings and townhouses or
9 condos that might actually have -- they're sharing
10 a wall. The wall might actually be the closest
11 one that the furnace has. So it can't actually be
12 vented through that wall because it will be going
13 through the other apartment. So that wouldn't be
14 a good idea and it actually has to go through a
15 different wall or multiple walls.

16 So we make some assumptions about what a
17 fraction of the time there will be apartment that
18 wit will be really hard and you have to go through
19 multiple walls or very, very long vent length. So
20 that's taken into account.

21 MR. CYMBALSKY: So the takeaway there,
22 you know, just to generalize about the

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1 installation, the analysis in the spreadsheet, and
2 you can see the numbers, takes into account the
3 range, the entire breadth of different venting and
4 installation costs associated with that. So I
5 think that was an earlier question, so.

6 MR. FRANCO: So obviously it's pretty
7 complex. There's a lot of details very specific
8 to furnaces. And I'm just browsing through it,
9 right, but if you have any specific questions,
10 we'll see if we can answer them.

11 MS. JACOBS: This is Diane Jacobs from
12 Rheem. So you don't know which side is the front
13 of the house. So you're assuming -- you must be
14 assuming the furnace is somewhere and then the
15 closest -- are you putting it like in the middle
16 and then you're finding the closest wall or --

17 MR. CYMBALSKY: That's deliberative too,
18 so yeah.

19 MS. JACOBS: Oh, okay.

20 MR. CYMBALSKY: That'll be part of the
21 NOPR conversation.

22 MS. JACOBS: Okay.

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1 MR. FRANCO: That's correct.

2 MR. STANONIK: Frank Stanonik, AHRI.

3 But okay, I'm looking. The example right here,
4 you have two columns.

5 MR. FRANCO: Yes.

6 MR. STANONIK: And these are inputs,
7 right?

8 MR. FRANCO: That's correct.

9 MR. STANONIK: So what -- oh okay, never
10 mind. Missed the heading.

11 MR. FRANCO: I'm sorry, and I should
12 have gone over this at the beginning. All of
13 these worksheets have -- because we have two
14 products. No, there are other spreadsheets that
15 you might have like 16 product classes, different
16 products and then you have 16 columns. In this
17 case, we're only analyzing non-weatherized gas
18 furnaces and mobile home gas furnaces.

19 In the case of installation cost, you
20 can see that the inputs for non-weatherized are a
21 lot more. There's a lot more going on. Mobile
22 home, there's a lot less. It's more simplified

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1 because it's a different installation type.

2 MR. CYMBALSKY: So is there a table you
3 can point to that shows the values for --

4 MR. FRANCO: Yes, we're going to go to
5 that. So let me just mention that then there's
6 other inputs that are coming. We assume some AFUE
7 efficiency that's associated with the building,
8 the year that the house was built, the age of the
9 equipment that's currently being installed, what
10 type of wall is being.

11 So obviously if you have a wall that's
12 wood or something, it's very easy to drill a hole.
13 But if you have a brick wall or you have some
14 other, then it's more expensive. So we have that
15 from RECS. And also we mentioned about if they
16 have commonly vented or not. So we want to know
17 if it has the water heater and what kind of air
18 conditioner equipment for some of the other
19 assumptions that we're trying to make.

20 MR. SCHROEDER: So in that section I
21 actually just have a question. I think I can stay
22 away from being deliberative. This is Dave

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1 Schroeder, sorry. So in this particular example,
2 we have an AFUE existing of 90 percent, right?

3 MR. FRANCO: Yes.

4 MR. SCHROEDER: And that's I think just
5 randomly assigned, right? That's coming out of
6 RECS because that's not in there.

7 MR. CYMBALSKY: So this home already had
8 a condensing furnace.

9 MR. SCHROEDER: This home already had a
10 condensing furnace.

11 MR. FRANCO: Correct.

12 MR. SCHROEDER: In this case, if you run
13 this model for the 90 percent case, would there be
14 any life cycle impact, you know, in basically the
15 case where they reinstall what they have?

16 MR. FRANCO: So the differential,
17 because then you would be comparing more between
18 if you're going from 90 to 90, there's no
19 differential obviously. But then if you're
20 comparing 92 to 90, it depends on the assumptions.

21 MR. CYMBALSKY: It depends on what
22 standard level you picked.

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1 MR. FRANCO: Then there might be a
2 differential.

3 MR. SCHROEDER: Okay. But if you just
4 picked the 90 standard, then there would be zero.

5 MR. CYMBALSKY: It would zero, right.

6 MR. FRANCO: Yeah.

7 MR. SCHROEDER: Okay. So it would be in
8 the no impact work out.

9 MR. CYMBALSKY: Correct. It would be in
10 the non-impacted. They're already there, yeah.

11 MR. FRANCO: That's correct, yeah.

12 MS. PETRILLO-GROH: Laura Petrillo-Groh,
13 AHRI. What does five mean for installation
14 location?

15 MR. FRANCO: Yes, and --

16 MR. CYMBALSKY: So that's back to the
17 original -- I think --

18 MR. FRANCO: Let's go back to the
19 statistics. Five actually means indoor. There is
20 -- we try to have as much as possible what those
21 mean.

22 MR. CYMBALSKY: So you go to building --

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1 MR. FRANCO: If you go to building
2 sample --

3 MR. CYMBALSKY: Right.

4 MR. FRANCO: There is -- and we haven't
5 gotten there yet but let's just go there now.
6 There is a definition here of the numbers.

7 MR. CYMBALSKY: Yeah, so this is where
8 you pick up all those parameters you see on the
9 other spreadsheet. So if you wanted to pick up a
10 different set from the sample, this is where you'd
11 come in here and pick the one you want to do.

12 MR. FRANCO: And here is the list. So
13 for example, five is indoor. Four would be garage
14 crawlspace, basement, conditioned or
15 unconditioned. This would give you the list.

16 MS. PETRILLO-GROH: And because this is
17 looking at the case for one house and then this
18 goes through the Crystal Ball to assume some
19 distribution of installation in any of those other
20 locations?

21 MR. FRANCO: That's correct. So a
22 specific household, it's indoor location.

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1 MS. PETRILLO-GROH: Thank you.

2 MR. FRANCO: Yeah, and in another
3 location obviously it would be something else.

4 MR. CYMBALSKY: Right, so if you're
5 playing around with the spreadsheet, this is a
6 good question actually. So you come here and you
7 say, actually I want to do this house and then
8 write down what parameters from this table and
9 then you go to the other one and change five to
10 four and you can see the numbers change.

11 MR. FRANCO: How that would vary.

12 MR. CYMBALSKY: Yeah, so you'll see you
13 can go house by house to see if it makes sense.
14 If you changed it from the house type and the
15 location, et cetera, do the numbers that you think
16 would change in a positive direction change in a
17 positive direction. So that's like a good error
18 test that you might want to make, so.

19 MS. PETRILLO-GROH: Thank you.

20 MR. FRANCO: Thank you for the question.
21 So let me first just go to the final results
22 before going into more details. So at the end of

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1 it, for this case, we've divided them out into
2 certain categories of installation costs. So
3 we've divided them into the basic installation
4 costs and what those are, they're very similar for
5 all furnaces. It's just putting in a furnace,
6 taking the old one out. It's the replacement one.

7 That's just a basic installation. Then
8 there's some venting costs associated with them
9 and this would be the next column. Then there is
10 if sometimes when you're installing, you're going
11 from 80 percent to a 90 percent and you have
12 commonly vented water heater, you get into
13 something else called orphan water heater and then
14 this would be the associated cost.

15 In this case, there is no orphan water
16 heater. It's going from 90 to 90 so there is no
17 cost. And then you go into the condensate drainage
18 and that's applicable only to condensing
19 equipment. And then you get the sum of all these
20 and this would be your installation cost only for
21 non-weatherized gas furnaces. When you get into
22 equipment switching, there's additional costs that

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1 are being calculated separately. And again, we're
2 doing two product classes at the same time. Below
3 here you can see the mobile home and they have
4 different assumptions.

5 MR. CYMBALSKY: So I think now might be
6 a good time to pause for a little break. So let's
7 say five after. Ten minutes enough for everyone?
8 I know -- okay, so quarter after, reconvene.

9 (WHEREUPON, the foregoing recessed.)

10 MR. CYMBALSKY: -- today. So just to do
11 an agenda check, so we're going to hit up the
12 product, the fuel switching/product switching next
13 and then head into the NIA. I seriously doubt
14 we'll get to the GRIM model today. But my sense
15 is that these first two spreadsheets have more
16 interest anyway. We could -- like I said, if we
17 need to have another meeting like this on
18 methodology, we're happy to do that at a later
19 date.

20 Before we turn it back over to Victor on
21 the switching, we had a couple of questions that
22 were asked on the webinar. One of them from Carl,

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1 that's a deliberative question. So we're going to
2 table that for the NOPR meeting. Another question
3 came to

4 UNIDENTIFIED MALE: Can you tell us what
5 the question is so we know --

6 MR. CYMBALSKY: It's about the venting
7 and it's very specific about what we considered;
8 for example, sidewalks, streets, average snow
9 heights, et cetera, et cetera. So you know, we'll
10 get into that at the NOPR stage. And then David
11 Peretti asked more specifically about in the water
12 heater costs, can you explain what the water
13 heater is and did you have all these units -- what
14 type of unit it was, what did it have a power
15 vent, et cetera, et cetera, et cetera.

16 So this is a good segue I think into the
17 next portion of the presentation. And what we can
18 say about switching, it's not going to be much
19 because all of what's going on is mostly going to
20 be explained at the NOPR stage. But I will say
21 that the switching routine is based on economics,
22 okay? And so, if we think about that in a very

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1 broad sense, the economics of a particular
2 consumer to switch, the reason they considered it
3 is because the option in front of them is costly
4 and they're looking for a less costly alternative.

5 So if you just use that, if we frame it
6 that way and leave it at that, we can't get into
7 any more detail than that. I think what I just
8 said answers David's question in terms of what
9 type of water heater or what type of heat pump
10 they might consider.

11 Clearly it's an economic decision.
12 They're switching based on an economic decision.
13 What is their alternative? That doesn't -- it
14 probably means that they're least cost people,
15 right? So just think of it that way. I'm not
16 going to answer it anymore beyond that. But I
17 think it's pretty clear that the switching's for a
18 reason and we'll leave it at that.

19 So back to Victor. We'll hopefully --
20 like I said, fuel switching, NIA and then we have
21 to -- we have to end at 1:00. So here we go.

22 MR. FRANCO: Great. Thank you, John.

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1 Victor Franco again. I just wanted to spend five
2 minutes just to go over a little bit all the other
3 worksheets, just very briefly and then we'll go
4 right into fuel switching just to finalize. And I
5 wanted to bring two points into the installation
6 cost. Obviously the installation cost, the
7 calculations and some of the additional
8 assumptions if you're trying to understand this
9 spreadsheet are below, and there's many, many
10 other aspects of it that are going here in this
11 area. And you can see there's distributions and
12 there's assumptions and based on locations and
13 just wanted to emphasize that.

14 The next is there are some forecast
15 cells. So you can disaggregate what kind of costs
16 are going to the individual household. So if you
17 actually wanted to look at one household or the
18 10,000 households and look household by household,
19 you can actually do that as well and see what the
20 basic installation, what the venting cost, was it
21 applied, wasn't it applied. You can do that as
22 well.

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1 The actual calculation, there are two
2 parts. One is the detailed part. Actually we're
3 calculating the individual components that go into
4 it. What's the cost of the thermostat? What's a
5 little bit of the gas piping, the connection, the
6 actual installation? And for venting, different
7 types of components that are going into it. Then
8 those are summed up and then they go into this
9 kind of subtotal field, the installation cost
10 component. And then those are totaled up in what
11 we were looking at before the break, which would
12 be this part.

13 When we come back to fuel switching,
14 there's actually -- below there's a fuel switching
15 component. And similar to equipment cost, those
16 are -- they're different assumptions and they're
17 different costs that are associated with those.
18 The last point because now we're wrapping up the
19 total installed costs is that these costs are then
20 inputted into, again, the payback -- LCC payback
21 calcs.

22 So if we go into one of these fields,

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1 these are picking up the retail installation cost
2 that we got from those two worksheets. And that
3 gives us the total installed price. So that kind
4 of wraps up that part. The final, final, final is
5 that if you wanted to look again from the 10,000,
6 what is the average, for example, you could go to
7 the summary and then this is the average of
8 everything. Of all 10,000, this is the total
9 installed cost. This is the average from 90 and
10 that's your differential.

11 And obviously everything that we discuss
12 about individual households goes into these --
13 coming up with these final results. So hopefully
14 in five, maximum 10 minutes, really briefly go.
15 So there's a lot of other inputs that are going
16 into this. Next would be the adjusted final
17 installation cost. There's actually an
18 installation cost data sheet that's being pulled
19 out, some data. This is just data. And then
20 there's a sheet that pulls out labor costs.

21 And for example, in this sheet you
22 actually have different labor costs for different

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1 regions of the country that's being pulled out
2 into here. And so, for individual households, if
3 you see what the cost is, you're going to get \$43
4 here for example. But if you go to another region,
5 it'll be completely different because it's a
6 different region of the country.

7 Maintenance and repair is also taken
8 into account. Now we're talking about the
9 operating costs and so this now goes into costs
10 that happen after the installation of the product.
11 There's some different considerations, assumptions
12 that are going into the calculation.

13 But again, it's a similar structure. We
14 have some import parameters. We have the final
15 results which show the exports. And we have non-
16 weatherized and the switching again. And we have
17 some calculations or assumptions, intermediate
18 calculations that are going on. So obviously we
19 don't have time to focus on everything. But these
20 are very similar. A lot of the products have this
21 type of setup.

22 Let's go before going to the building

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1 sample, or get -- okay, let me just use building
2 sample really simply. So this kind of ties up the
3 idea of what are the weights that are being used.
4 And this is very important to understanding what
5 data's being pulled and how often it might be
6 pulled. Here, we provide the actual weighting
7 that we're using in the spreadsheet. We actually
8 have two sets of weights. We have a replacement
9 sample and a new construction sample.

10 This is residential. And in the case
11 for this product, we also have building sample for
12 from CBECS. And a same, we have replacements and
13 new construction. If you go through -- let's go -
14 - for example, there's not a lot of commercial
15 buildings that use residential. So you see a lot
16 of zeroes. So essentially, if it's a zero, it's
17 not being used. But you'll find that there is
18 one, for example, here that has a weight, 139.

19 So let's discuss a little bit what that
20 weight means. So RECS provides a weight that's
21 based on the actual weight of the stock of that
22 building, the building stock. Now, what we're

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1 trying to do is we're trying to look at the
2 shipments and the shipments in 2021. So we do our
3 own weight, weighting that's based on shipments
4 and that produces a different result which
5 actually matches the number of shipments that are
6 in the NIA spreadsheet.

7 In this case, we have 3.5 million
8 shipments in 2021. We went to the NIA spreadsheet
9 and this is a result. And then, there's a logic
10 between how many are replacements and how many are
11 new construction that is also provided by the NIA
12 spreadsheet. In this case, it's about 25 percent
13 new construction, 75 percent replacements and
14 about 97 percent are residential and 3 percent are
15 commercial. That all comes from the NIA
16 spreadsheet.

17 The last part is -- so now that you
18 understand that these are the weights, RECS
19 provides for that building different inputs. So
20 for example, let's say this is a building that's
21 being sampled, building number ID 2 from RECS.
22 These are all the inputs that we use in our

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1 analysis. These are what's being captured. And
2 you can see over here this is actually called
3 export parameters and this is what's being
4 captured. And this goes to different worksheets.

5 The last thing here to then look at is
6 what's the actual household ID that's being used
7 for this and you need to look at two things. So
8 one is whether this is from the RECS or CBECS.
9 This is actually being pulled from the CBECS
10 sample. This is two. Let's change this to one
11 just to look at a RECS. The household that's
12 actually being sampled is 5,975. So if you want to
13 actually look at that household, you would have to
14 go 5,975, go all the way down and you would see
15 what those inputs are. And those are the inputs
16 that are being picked up for that household.

17 Hopefully that gives you a little bit of
18 an understanding of what's going on and how you
19 might be able to change to see a specific
20 household. Obviously you could change what's
21 being --

22 MR. STANONIK: Victor, okay -- so these

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1 first two columns for the RECS data -- okay, so as
2 I understand RECS, it's a survey of certain
3 thousand number of houses, actual survey of
4 houses, right?

5 MR. FRANCO: Correct.

6 MR. STANONIK: Twelve (thousand),
7 13,000, something like that?

8 MR. FRANCO: That's right.

9 MR. CYMBALSKY: For the 2009 survey.

10 MR. STANONIK: Yeah, yeah. Okay, so
11 that's the first column. It's that particular
12 house, right? So then the weighting is what, the
13 estimate of the number of houses nationwide that
14 are like that ID?

15 MR. CYMBALSKY: Correct.

16 MR. FRANCO: This column I, yes, it's
17 called end weight. That's actual variable that's
18 provided from RECS.

19 MR. CYMBALSKY: From RECS and it's the
20 weighting that they use to make the sample to a
21 population.

22 MR. FRANCO: Correct.

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1 MR. STANONIK: All right, so if we want
2 to - - okay, so I guess -- well, it'd be nice if
3 that was just a percent in terms of trying to
4 understand the effect of the weight, I guess. But
5 okay.

6 MR. CYMBALSKY: Well, I think for the
7 math to work out you need to have a number.

8 MR. STANONIK: I got it, yeah.

9 MR. CYMBALSKY: But sure, you could
10 actually just make another column, sum it up and
11 do your division if you'd like.

12 MS. JACOBS: Okay, and then the fourth
13 column you said was DOE assigned it their own
14 weight?

15 MR. FRANCO: That's correct. For each
16 of --

17 MS. JACOBS: And what's the basis -- how
18 do you come up with 357 instead of 85, 56 or --

19 MR. FRANCO: So basically the baseline
20 shipment we know by state how many shipments have
21 been historically shipped to certain regions of
22 the country.

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1 MS. JACOBS: How is that related to a
2 house? Oh, you're just going regional?

3 MR. FRANCO: Yes, regional.

4 MS. JACOBS: Okay.

5 MR. FRANCO: Because we have shipments
6 by state and that slightly changes the
7 distribution.

8 MR. STANONIK: If I can, so would it be
9 fair -- as an example, okay, so the number two,
10 the weighting is what, it looks like 85 or
11 something. Let's say it's 8,600. I'm just looking
12 at the second column. Let's say it's 8,600.

13 MR. FRANCO: Yes.

14 MR. STANONIK: If we knew that in the
15 U.S. let's say the mix of heating was 50 percent
16 gas, 50 percent electric and being very simple
17 here, then the weighting for the gas furnace would
18 be half of that number, right, if there were no
19 whole other issues. That's kind of what you're
20 doing, right? Kind of?

21 MR. FRANCO: Not completely clear your
22 question. But let's say for example there's 110

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1 million households in the U.S. and you're saying
2 that 50 percent are gas. So let's say that's 55
3 million households. And then this represents
4 8,600 houses. So if you divide 8,600 divided by 55
5 million, that gives you the percentage that
6 represents.

7 MR. STANONIK: Yeah, right. That's kind
8 of what you're doing on a little more
9 sophisticated basis.

10 MR. CYMBALSKY: Use the mic.

11 MR. STANONIK: Pulling in shipments
12 because you're looking at what happens -- oh, I'm
13 sorry. Frank Stanonik. But so you're pulling in
14 shipments because you're really interested in
15 what's happening as we go forward in terms of
16 energy savings year to year.

17 MR. FRANCO: Exactly.

18 MR. STANONIK: Got it, okay.

19 MR. FRANCO: And here then how you would
20 do it is from 3.5 million shipments, you divide
21 this 357 and that gives you the fraction of how
22 often this would be sampled probability-wise. So

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1 that hopefully helps you out how this is done.
2 Now, let me just really point out because I know
3 that this might be something that you want to play
4 around with, how you might want to play around
5 with this.

6 So for example, there's one. So for
7 example, let's say you want to change the
8 residential commercial sampling or you just want
9 to look at residential. This would be the cell
10 that you would change that in and then you would
11 change that part. Let's say that you want to
12 actually change the distribution so that this gets
13 into actually using Crystal Ball. And then, you
14 would maybe change this numbers here and then
15 these actually numbers are being populated down
16 here. Let me see if I can -- yeah.

17 So these numbers are coming from these
18 cells as the sample. Then you could actually have
19 to change this. Let me see if this doesn't take
20 too long. Okay, great. That didn't take too long.
21 This is the actual looking at the household IDs,
22 12,000 household IDs and what's their relative

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1 probability of being shown up. So if you change
2 it here, then you would change your sample. So
3 for example, let's say you only wanted to look at
4 households in New Jersey or you only wanted to
5 look at households in California. So then you
6 would take out all households that are not in
7 California or not in New Jersey or something like
8 that. Then you would have to change here the
9 distribution. Then you would be only looking at
10 the impacts for that specific part.

11 MR. MILLER: Just a process question on
12 that. How would you then do that thing you just
13 said? How would I -- just as an example, how would
14 I just get New Jersey?

15 MR. FRANCO: So that requires two
16 things.

17 it's the first thing is the easiest way
18 to do it is you would maybe have an equation here
19 or just have some way of which ones you are
20 picking up or just two columns. Basically you
21 just need two columns. One is the ID column that
22 matches this number and then some kind of weight.

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1 And say, for example, you wanted to use non-
2 weatherized, this, the RECS weight for example.

3 And so, let's say for example we want to
4 equal this to this. Whoops, let's say, another --
5 so for example, let's say so every time this pops
6 up, that's a gas furnace. So you have the logic
7 that it's a gas furnace. Instead of using this
8 weight, you use this weight, for example. Or that
9 only households in certain part of the region pop
10 up, something like that. So you have your logic.

11 Then after that, the way to do it in
12 Crystal Ball is you want to select these two
13 columns as your data fields and you kind of blank
14 out what was there before. Do you want me to go
15 through that or --

16 MR. CYMBALSKY: That's a lot more time
17 than I think we need to do on that right now.

18 MR. FRANCO: Okay, great. So yeah, but
19 that's basically how you would do it. So I think
20 that was all to kind of get a sense again. All
21 these are the inputs that are going. We tried to
22 make it so that you know where things are going

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1 to. And hopefully you get a sense that there's a
2 lot of data that's being pulled from RECS.

3 Now, let's very briefly go -- and this
4 is kind of a question that was asked before a
5 little bit about how the selection of the
6 efficiency of the current household is being
7 conducted. And so, it happens here. This is
8 called the base case AFUE. And so, this would be
9 the AFUE of the household that's installed in
10 2021. There is -- it depends on the region. We
11 have some efficiency shipments by efficiency,
12 historical shipments by efficiency for each
13 region. So for example, in northern states, they
14 have a larger fraction of condensing. Southern
15 states, they have a larger fraction of non-
16 condensing.

17 Based on that region, for example, now
18 it's being sample region 21, for example, let's
19 say Texas, it's looking up that 97 percent of the
20 time it's going to be non-condensing. And so, for
21 this household, it actually is picking up 80
22 percent AFUE as the existing furnace in that.

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1 Now, if you're in a different region -- let's say,
2 for example, you're here in a mobile home, has a
3 different distribution. It's actually picking up
4 92 percent because it's actually in Kansas and
5 Nebraska. So it's more likely that it'll be a
6 condensing.

7 MR. SCHROEDER: This is Dave Schroeder.
8 Did you say that those distributions have been
9 projected to 2021 or this is --

10 MR. FRANCO: That's correct.

11 MR. SCHROEDER: Okay, so this isn't
12 current. This is 2021 projected.

13 MR. FRANCO: And now we'll go into the
14 historical part. Just one very brief point. If
15 you notice, there's a lot of tables, lookup tables
16 and that depends on the market. So this one that
17 I was showing is just residential replacement.
18 Obviously if the household is a commercial, it has
19 a different distribution or if it's new
20 construction, the distribution is below. Mobile
21 home has a different distribution.

22 So that deals with the 2021. Now, if

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1 you want to look at the existing, then this is
2 this sheet. And this sheet again looks by region
3 and looks at historical data and we stop at 2009
4 because that's when RECS's last year and for
5 commercial 2003. So then you look at the age of
6 the furnace. For example, this one is 2005
7 because it's 2009 minus four years. It's already
8 four years old and then you will look at the 2005
9 distribution based on the ID of the equipment.
10 And so, this one is actually pricing ID seven. So
11 that's how that functions.

12 For air conditioning and heat pump
13 equipment, the historical efficiency comes from
14 these average shipment-weighted distributions. So
15 depending on the age of the equipment, you
16 actually have an average.

17 MR. STANONIK: Victor, this is Frank
18 Stanonik, AHRI.

19 MR. FRANCO: Sure.

20 MR. STANONIK: And John, I may be
21 getting a little again off here. All that
22 information on the right, you said that it's

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1 distribution.

2 MR. FRANCO: Yes.

3 MR. STANONIK: That's shipments, though,
4 right, not distribution products in the field.

5 MR. FRANCO: That's shipments and
6 percent of shipments.

7 MR. STANONIK: Okay. I just want to
8 make sure we're clear.

9 MR. FRANCO: Yes.

10 MR. STANONIK: Okay.

11 MR. FRANCO: Yes, yes.

12 MR. M. HUNT: Victor?

13 MR. FRANCO: Yes.

14 Mr. M. HUNT: Can I back up just to
15 where we were? The 2021 forecast of installations
16 -- so in New Jersey, the 31 percent that are still
17 going 80, that's because they would have failed in
18 economic tests to move to high efficiency -- no?

19 MR. CYMBALSKY: This is the baseline.
20 So this is not the standards.

21 MR. M. HUNT: So --

22 MR. CYMBALSKY: This is absent --

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1 MR. M. HUNT: Absent anything happening,
2 this is what would have happened in 2021.

3 MR. CYMBALSKY: Right.

4 MR. M. HUNT: Okay.

5 MR. CYMBALSKY: With no regulation.

6 MR. M. HUNT: With no regulation, that's
7 what would have happened.

8 MR. STANONIK: Additional regulation.

9 MR. M. HUNT: Right.

10 MR. CYMBALSKY: We haven't had a
11 regulation in this space since I've been alive I
12 don't think, Frank.

13 MR. STANONIK: I'm sorry.

14 MR. M. HUNT: So moving forward, you
15 mentioned that the -- we're not there yet.

16 MR. FRANCO: Great, so a couple more
17 topics here. So the next big one is energy use
18 and obviously we don't have time to go too much
19 into energy use. Energy use is very, very similar
20 to everything that we've been talking about, has
21 input parameters, has export parameters. It's
22 actually divided by month. We try to estimate what

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1 would be the monthly and we then compare that to
2 energy prices. We actually have average and
3 marginal energy prices would be the next topic
4 that are by month and we tried to match both the
5 fuel use and electricity use to those prices.

6 We then have the actual calculations as
7 part of the -- so the more complicated
8 calculations as part of this energy use calcs just
9 for the non-weatherized gas furnace and mobile
10 home. That's part of this worksheet. And this
11 worksheet goes into a lot of detail. It's very
12 similar to the test procedure and assuming how
13 often if it's a two-stage it would be in the high
14 and the low, makes all these assumptions and
15 calculates the end result is -- let me go back a
16 little bit -- is the actual heating energy use and
17 electricity use which would be these two columns.

18 And then that gets inputted into the
19 previous sheet, which is the energy use. Stop me
20 if I'm going too quickly, but we kind of need to
21 go a little bit quickly. Now, the energy use for
22 the equipment that we discussed are the switching

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1 -- is available here in this sheet. This is again
2 the calculation of the heat pump, CAC equipment
3 and the water heating equipment, either electric
4 or gas equipment and this would go into the sheet.

5 Very similar, they have some import
6 parameters. You have the calculations and the end
7 result are by month the energy use.

8 MS. JACOBS: Can you make that a little
9 bigger?

10 MR. FRANCO: Sure. Yeah, and I'm very
11 sorry because we're kind of rushing through. But
12 please stop me if -- yeah, if there's something
13 that you want to look at more carefully. And
14 here's the export. And obviously there's a lot of
15 input data that goes into that that we're trying
16 to calculate. So here is the monthly. You can
17 see here for electric furnace and we'll see this
18 in a little bit more detail once we get to the
19 switching and then the annual value for this
20 particular electric -- in this household.

21 Now, there's some data that's being
22 pulled out that's necessary for others. For

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1 example, we need to determine what's the size of
2 the furnace and the air conditioner. This would
3 be the worksheet where that gets determined. We
4 don't have time to go into that detail but that's
5 where this is determined. I'll just leave it at
6 that. Energy prices, this is where those are
7 being determined. These are the energy prices in
8 2012. This is the reference here, 2012. And we've
9 calculated both average energy prices and marginal
10 energy prices.

11 Just wanted to briefly go very quickly
12 how that's being done. We have by region we have
13 monthly energy prices. These would be the average
14 monthly energy prices and then both for natural
15 gas and electricity we have marginal price factors
16 either for non-winter and winter. We calculate
17 these price factors. So what happen when you have
18 a region that you're looking at, say for example
19 we're in region 21, we go look up, for example,
20 the prices in Texas. These would be the monthly
21 prices in Texas.

22 This would be the average. These are

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1 being picked up over here for natural gas fuel.
2 And then, we multiply those times the marginal
3 price factors either if it's a winter or summer or
4 non-winter month. And this would give you the
5 marginal price. In this case, for this particular
6 household, the price for example in January month
7 one would be \$9.05. The marginal is \$7.67. So
8 it's lower and that's the price that's being
9 applied for that house.

10 MR. STANONIK: That's the price being
11 applied -- Frank Stanonik, AHRI. Which price is
12 being applied, the nine whatever or the seven?

13 MR. FRANCO: Yeah, that gets -- just I
14 don't know how much I can go into detail. But the
15 average gets applied to kind of your base energy
16 use and the marginal is to your savings. I think
17 I can --

18 MR. MILLER: This is Bud Miller. The
19 development of the marginal price factor, can you
20 discuss that?

21 MR. CYMBALSKY: No, we can't. That's
22 deliberative.

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1 MR. FRANCO: Okay. The last part of
2 that is obviously those are costs for 2012 and
3 then we want to project those to the future. We
4 use AEO projections and because 2012 is the start
5 year, obviously that's one. That's the start
6 year. And then, as we project further, we have
7 this factor. So the number that we looked at
8 before times this 1.075 would be the price in 2021
9 and then so on as you go further in time. These
10 are projections are by the census division. That's
11 how AEO defines this is the census division.

12 So the last two parameters before going
13 to fuel switching, well, let's just finish with
14 energy usage. These adjustment factors that we do
15 for climate conditions and there is some weather
16 data also associated with it. And so, those are
17 adjustments that are used in the energy use
18 calculation.

19 The two other important parameters that
20 are being used are the discount rate. Those are
21 being calculated in the sheet. Again, we have
22 some import and we have some export data and

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1 export data obviously is the discount factor, and
2 the lifetime. And the lifetime is a distribution
3 and these are the parameters that go into
4 lifetime. We have different lifetime for
5 different equipment.

6 So we have one lifetime for furnaces,
7 one lifetime for water heaters and one lifetime
8 for central AC and heat pump and these are the
9 resulting values that are coming from just doing
10 one run. If you wanted to see some of the
11 statistics, again you could look at defining the
12 assumptions.

13 And for example, here the statistic is
14 the mean of this distribution is 21.5. You can
15 look at other statistical information. You can
16 actually look at the probability and this is a
17 Weibull distribution and so you can actually see
18 how that looks and more or less 21.5 is right
19 here. So that's and you can go look at the other
20 ones as well.

21 Similar to -- and these parameters, if
22 you wanted to change that, then you could either

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1 change the assumption or you could take out the
2 assumption and just have a fixed value. So that's
3 how you would handle changing something like this.

4 MR. STANONIK: Victor, Frank Stanonik,
5 AHRI. And I think this is a general question.
6 When you're running these analyses, does DOE
7 normally use a different discount rate for a new
8 installation compared to a replacement
9 installation on the theory that a new
10 installation, your cost is really I'll say hidden
11 in your mortgage as opposed to a replacement is
12 likely, you know, direct consumer payment, if you
13 will, or I'll say charged at a different rate? I
14 mean --

15 MR. CYMBALSKY: That'll be a NOPR
16 question.

17 MR. STANONIK: Okay.

18 MR. FRANCO: So the next big topic is
19 fuel switching. So we actually have a sheet
20 that's called non-weatherized switching and this
21 is completely different from any other product
22 that we have. So this is something that you would

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1 only see here in the furnaces. Everything else
2 is, as we talked about, is very similar.

3 So this sheet is kind of like the
4 calculation sheet of switching when it occurs. So
5 again, this is a very, very introductory. There's
6 a lot of details that are associated. I'll try to
7 go as much as I can. But we also want to get into
8 the NIA. But please stop me if there's something
9 that I can answer in here.

10 So there's some input parameters as
11 before and there's some logic that goes into why
12 we do certain things. Some of them we can't
13 really talk about but I'll try to best present
14 what's here without going too much into the
15 analysis. One thing just to understand the
16 structure is that you have different situations.
17 Let me call it like that.

18 So you might have a household that's in
19 RECS that has a non -- starts with a non-
20 weatherized gas furnace. All these start with a
21 non-weatherized gas furnace obviously. And then
22 they have either a gas water heater or an electric

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1 water heater. So that'd be the second level. And
2 so, this is, for example, the first is they just
3 have a non-weatherized gas furnace and gas water
4 heater.

5 For this one, they don't actually have a
6 cooling. They might have a room air conditioner
7 or no cooling, something else. Then the next one
8 that we find is non-weatherized gas furnace and
9 electric water heater. Then there's households
10 that have non- weatherized gas furnace, gas water
11 heater, central air conditioning. Those are
12 usually the most common. Then we have non-
13 weatherized gas furnace, electric water heater,
14 CAC and then the same but with a heat pump. And
15 obviously this is just data from RECS, like that's
16 how the households are currently being built.

17 From that, obviously we're then looking
18 at what would be the switching options. In this
19 case, the households that we're looking at is a
20 household configuration. So let me go back here.
21 This is kind of the data that's being pulled from
22 RECS. So for this household, it hasn't obviously

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1 all households have non-weatherized gas furnace,
2 gas water heater and a CAC unit and a
3 configuration and it's seven.

4 An additional thing that this household
5 has is that we assume that this is commonly vented
6 and that comes from some of the assumptions in the
7 installation costs. But because it has these two
8 plus some other considerations, this is commonly
9 vented. So that's another important parameter.

10 But this is basically a configuration
11 number seven. So if we go back, this is what we
12 were talking about, configuration number seven.
13 So if you're in configuration number seven, you
14 have some different switching options. So this is
15 the more -- the one that has the most options. So
16 you could again go with a non-weatherized gas
17 furnace, which -- so we're only considering the
18 case where you're going from an 80 percent non-
19 condensing to a condensing when we're doing the
20 switching.

21 So one is that you remain with a non-
22 weatherized gas furnace. But because of the

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1 standard, you have to go to condensing. And you
2 remain with your existing equipment, gas water
3 heater and central air conditioning. But it could
4 be the case that you're commonly vented and it
5 might not work out. You might want to install an
6 electric water heater. So this would be that
7 option. So this is option eight. The next is you
8 actually switch your electric -- you're going from
9 a non-weatherized gas furnace to an electric
10 furnace. You switch your heating but you remain
11 with the same cooling equipment.

12 Then the next thing is that you could do
13 is -- and obviously you could do gas water heater
14 or you'd switch to an electric water heater. The
15 next thing you can do is you switch to a heat pump
16 so that essentially switches your cooling
17 equipment and you have to have an air handler as
18 well. So those would be the options.

19 MR. M. HUNT: Victor? Victor, this is
20 Marshall Hunt at PG&E.

21 MR. FRANCO: Sure.

22 MR. M. HUNT: The column O, I just don't

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1 understand what the title is, hot water, water
2 heating to number two. What is that?

3 MR. FRANCO: Yes, yes. Sorry and that
4 probably is more like we understand. But
5 basically what this is telling us or the logic is
6 that whether it's switching to a different water
7 heater. So for example, here it's not switching
8 but here you're switching to electric. And so,
9 this is more for the logic. Yeah. Sorry about
10 that. That labeling there is not that clear.

11 So once we know that and we have all
12 those switching options, then we can go to the
13 calculation kind of piece of the puzzle here which
14 is this part, column R to -- all the way to column
15 AN, this part of the worksheet. Everything else
16 that we might talk about is the inputs to this.
17 So obviously because it's that configuration,
18 those are the options that are being picked up.

19 So we start with a non-condensing, non-
20 weatherized gas furnace, seven, and then if we are
21 going to look at 90 percent standard, these would
22 be the options that it could switch to and this

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1 would be the 90 percent and then at 92 these would
2 be the options again but now you're looking at 92
3 percent non-weatherized, 95 and 98.

4 So depending on the economics, the
5 ability to switch might change if you're at 98 or
6 90 because the equipment price might be different
7 and so your economics will change. Everything
8 else here are the inputs. So the two primary
9 inputs that we're looking at here are the
10 operating cost, so it relates to the annual fuel
11 use and the electricity use, and the installation
12 cost -- the total install cost which obviously the
13 retail price, installation cost.

14 So the first row in each of these
15 switching sub-tables are what we've been talking
16 about. This is the one we were just looking at,
17 the non-weatherized gas furnaces. What's the
18 energy use? This is the energy use. What's the
19 electricity use? This is the electricity use.
20 What is the retail price? What is the
21 installation cost? What's the total install cost?

22 Then we have what's the maintenance.

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1 This is more of an input to the final result and
2 all these other parameters. When we're actually
3 looking at the switching, whether it's going to be
4 doing a switching or not, then we're looking at
5 kind of a payback criteria. So based on the
6 differential cost of going to a condensing 90
7 percent versus some of these other options, then
8 you have a certain payback. So let's look at that
9 a little bit more carefully how that works.

10 So the first thing we want to take a
11 look at when we're looking at this is we're only
12 considering cases where the cost of the equipment
13 you're switching to, the total install cost is
14 less. In the case of this specific household, the
15 only situation that occurs is in this option right
16 here, which I believe is an electric furnace, gas
17 water heater, CAC. And that's why the payback is
18 only being calculated for that.

19 Everything else is above that. So
20 that's the first thing. Then this switching is
21 basically just the switching payback is just
22 basically the comparison between the 90 percent

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1 and the switching option. And then the switching
2 occurs based on just a switching criteria payback.
3 Let's go back to the input. This is we're using a
4 3.5 year payback criteria. So based on that
5 criteria, we're saying that it's going to be
6 switching if it takes 3.5 years to pay back going
7 to the gas furnace versus switching to another
8 equipment.

9 If it takes less than that, for example
10 in this case 0.2, then it's not going to be
11 switching. Let's just see why this is occurring in
12 this case. Here we only have a differential of
13 \$200 between this and this, between the 90 percent
14 and the electric. But the differential in
15 operating costs is almost \$1,000. So obviously in
16 the first year, like 0.2 years actually here it's
17 not. It's going to be recuperated.

18 So that's -- it's not going to very
19 happen - - very likely that that's going to
20 happen. And then the model then assumes that
21 that's -- that doesn't occur in this case. So the
22 final output is actually going through all those

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1 in situations and seeing if there's going to be a
2 switching. So for example, in this case we start
3 with a seven option and we end up with a seven.
4 There's no switching, seven, seven.

5 If there was switching, then it might be
6 like seven to nine or seven to a different number.
7 And this might actually vary. It might be that
8 for this level it might be switching. For the
9 next level it might not be. It just depends on
10 the economics for that individual switching.

11 MR. SCHROEDER: Can I just ask a
12 question --

13 MR. FRANCO: So hopefully that finalizes
14 and let's go to questions. Yes?

15 MR. SCHROEDER: So I'll try to stay away
16 from anything deliberative here.

17 MR. CYMBALSKY: Name?

18 MR. SCHROEDER: Sorry, Dave Schroeder.
19 If there are multiple options that, say, cross
20 that 3.5- year threshold --

21 MR. FRANCO: Yes.

22 MR. SCHROEDER: Where is the logic

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1 contained that would decide which of those options
2 would get chosen?

3 MR. FRANCO: So it would be the one that
4 has the best economics of those options.

5 MR. SCHROEDER: But where in the model?
6 Is that in column D here near the bottom?

7 MR. FRANCO: This would be I believe in
8 -- and that's a good question. This would be --
9 this would be right here. As you can see, this
10 right here is looking at that row and that's
11 exactly -- the logic is embedded in here. So it
12 would be the one that has the more benefit. So
13 for example, let's go into a case and see. Let's
14 say either it's going to switch to a heat pump or
15 an electric furnace. Because the economics maybe
16 of the heat pump are very favorable because of the
17 operating cost, we assume that they'll choose the
18 heat pump.

19 But it could be that maybe the
20 economics, because of the install cost of the heat
21 pump is very expensive for another household, they
22 might actually choose the electric furnace. So it

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1 just depends on the individual case and the
2 economics and it's specific --

3 MR. SCHROEDER: And this allows for
4 negative numbers as well, right? You can have --
5 you could have negative cases here where you have
6 a first cost advantage and you have a first year
7 operations cost advantage.

8 MR. FRANCO: Yes. That doesn't happen.
9 For example, like with an electric furnace. But
10 it does happen for a heat pump. There could be
11 situations where you have a heat pump in a certain
12 region that the economics play out that the gas
13 price -- the electric and the gas prices are very
14 competitive to the electric price and you have
15 actually less operating costs compared to the 90
16 percent. So for example, in this column, you
17 might have that the heat pump option is less than
18 590 and that would lead to a negative result in
19 that case, correct. Yes?

20 Mr. MILLER: Just to make sure I
21 understand the answer of that thing, then in that
22 negative payback situation, there would be a

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1 switch?

2 MR. FRANCO: In that negative payback,
3 there would be a switch yes.

4 MR. MILLER: Thank you.

5 MS. PETRILLO-GROH: Hi. Laura Petrillo-
6 Groh, AHRI. How does this tab interact with the
7 building sample tab?

8 MR. FRANCO: Good question. So we kind
9 of very quickly went through that. But there are
10 some things that I kind of browsed over that are
11 important inputs obviously. So the first one for
12 the building sample is that it's picking up for
13 that household. It's picking up what type of
14 equipment it's associated with. It's picking up
15 that it's a gas water heater that's in the
16 household and it has a central air conditioner.
17 So that comes directly from RECS for that specific
18 household.

19 There's also some life remaining -- not
20 -- the existing equipment age that is also being
21 picked up from RECS. Those would be the primary
22 inputs that are directly. But everything else

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1 that's associated, for example, the installation
2 costs, energy use are originally some of the data
3 that to produce those are coming from RECS.

4 MS. PETRILLO-GROH: If I understood
5 correctly, the building sample only accounted for
6 households with gas. Does the information on fuel
7 switching get fed back to that?

8 MR. FRANCO: Repeat?

9 MS. PETRILLO-GROH: If the building --
10 the building sample tab only accounted for
11 households with gas, will the information from
12 this fuel switching tab get fed back and change
13 maybe the proportions of which homes now have gas
14 in them?

15 MR. FRANCO: I don't know if I can
16 answer that or not or --

17 MR. CYMBALSKY: Yeah, I don't -- so the
18 RECS sample -- can you just go back to the --

19 MR. FRANCO: I can answer but I don't
20 know if -- is it --

21 MR. CYMBALSKY: Well, you can't answer
22 the second part but just the first part. So go

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1 back to the building sample. So go down all the
2 way to the bottom of that table.

3 MR. FRANCO: A little bit further?

4 MR. CYMBALSKY: Just go to the end of
5 that table.

6 MR. FRANCO: Oh, oh the very end?

7 MR. CYMBALSKY: End of column H.

8 MR. FRANCO: Oh, okay. Yeah, I have
9 this thing here. It's kind of bugging me.

10 MR. CYMBALSKY: Let's do it end down
11 arrow key.

12 MR. FRANCO: Yeah.

13 MR. CYMBALSKY: It won't let you go down
14 to the bottom?

15 MR. FRANCO: Oh, I got it.

16 MR. CYMBALSKY: Well, there should be
17 9,000, or 12,000 or whatever. So this is
18 everything in the RECS sample. So there's RECS
19 had 12,083 sample. So we have the whole
20 population of the RECS database. So I don't know
21 what the gas -- I don't know.

22 MR. FRANCO: Well, this is -- what we're

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1 picking up as we're analyzing, as I think you
2 alluded to, are just the gas equipment.
3 Essentially the switching is if there's going to
4 be switching to electric. So that's already
5 picked up.

6 MR. CYMBALSKY: Right. So they already
7 have gas and when we apply the standard, the
8 methodology is will they switch. If they do, then
9 that gets fed in and the calculations run from
10 there.

11 MR. FRANCO: And I'll go actually a
12 little bit to that, how that works in the LCC and
13 then how that works in the NIA.

14 MR. CYMBALSKY: And logically, once you
15 switch to the condensing furnace -- well, once you
16 have a condensing furnace, you're locked in,
17 right? That's what you showed before.

18 MR. FRANCO: Yeah. Yeah, if you start
19 with the condensing furnace, obviously you're not
20 switching. It's only in the case when we assume
21 in 2021 that you start with a non-condensing and
22 then there's a potential of switching to something

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1 else.

2 MS. PETRILLO-GROH: Thank you.

3 MR. SCHROEDER: Can I ask a quick
4 question about the payback period, not about the
5 assumption behind it but we talked before about
6 the potential for breaking the model if you play
7 with things and change things. Is there any way
8 that changing that 3.5 year number breaks the
9 model?

10 MR. CYMBALSKY: So I think you can play
11 with the model and I think he showed you the
12 equation.

13 MR. FRANCO: So you can actually go
14 here. It's a fixed value. You can have this as
15 another number, a distribution, something else.
16 We actually have provided one for replacements,
17 one for new units. You can actually play with
18 that.

19 MR. CYMBALSKY: You can change it.

20 MR. FRANCO: The last thing then just to
21 kind of bring everything together in terms of fuel
22 switching is so this is the export parameter.

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1 Let's say that this household does switch and you
2 are actually going to something else. What would
3 happen is you go to the LCC payback calcs.

4 When we were discussing this, this is
5 again going back to this sheet that calculates the
6 LCC and so something that's very specific to this
7 rulemaking and furnaces is that we're actually
8 calculating the impacts in terms of the LCC. And
9 so, what happens is that if the household does
10 switch, then instead of picking up the 90 percent
11 AFUE as is the case of this household, it will
12 actually pick up what the energy use and economics
13 are of the switched equipment and then that's the
14 final results of what's being done. In this case,
15 it's just being 90 percent.

16 So there's no switching. But if there
17 was, then it would be looking at the values down
18 here and picking those up to have the appropriate
19 economic characteristics. And when you're looking
20 at the summary results, these summary results
21 include those potential switching.

22 So the end result, we added this summary

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1 switching tab. The summary switching tab has some
2 statistics to be able to see what's more or less
3 going on, what's switching to what, to kind of
4 understand what's going on. Obviously it's a
5 little bit -- a lot of information. But similar
6 to what we were talking about, you can kind of
7 see, well, the household started with certain
8 fractions and then you have a difference. And you
9 can kind of see the overall switching per
10 fractions. And so, that'll give you a little bit
11 of an understanding of what's going on.

12 MR. SCHROEDER: Sorry. This is Dave
13 Schroeder. Every house gets run for every
14 different efficiency level, right. And then
15 switching may or may not happen depending on which
16 efficiency level you're at.

17 MR. FRANCO: Correct.

18 MR. SCHROEDER: But then there seems to
19 be only one percent switching. So how does that -
20 - how does that work? Is that -- is that at one
21 set efficiency level?

22 MR. FRANCO: That's a very good

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1 question. So obviously this is a lot of data just
2 -- and we just -- we were trying to have something
3 here for stakeholders to see. This is just for 90
4 percent AFUE. You can actually have the same
5 table for 92, 95, 98. But then, the number of
6 forecast cells that you have to create to do that
7 balloons to a lot and we just decided to pick one.
8 But you could actually -- when you do -- when we
9 do the run, extract, you can actually look at all
10 the different combinations. And that's an easier
11 way to do it because once you're doing the
12 forecast, you keep increasing the number of
13 forecast cells very quickly to do that.

14 But hopefully this kind of illustrates
15 what's going on. There's actually a table down
16 here that kind of shows you what's going on by
17 efficiency. And you can see that it varies. So
18 for example, for 98, which would be TSL 5, you can
19 kind of see that there's more switching because
20 you have higher equipment costs versus the other
21 two. So you can kind of get a sense that yeah, it
22 does vary. But all other information provided is

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1 for 90 percent AFUE.

2 So let's now connect. Let's see how
3 much time we have. We have a little bit less than
4 an hour. So hopefully we can do NIA.

5 MR. CYMBALSKY: Yeah. So before we go,
6 I have a few questions that have come in.

7 MR. FRANCO: Sure.

8 MR. CYMBALSKY: So let's answer them
9 now. So we had a bunch of questions. I'm not
10 going to read all of them. But they're all pretty
11 much the same question. They asked about the data
12 sources for the energy price forecasts, do they
13 change, et cetera, et cetera.

14 So the energy price forecasts are from
15 the EIA most recent NEMS EIA annual energy
16 outlook. We basically start with our data set and
17 based on how those census division prices change,
18 we change the marginal prices and the average
19 prices, et cetera.

20 And then, we had a question about could
21 you remind us what year the product pricing is
22 from. So the analysis starts in 2021 and that's -

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1 - it's the forecasted price for the year 2021.

2 Dose the shipment data include imports or just
3 domestic? Yes, it has everything.

4 And then another question about why the
5 rebuttable presumption showed different results on
6 the summary sheet. It's a different -- a little
7 bit different analysis. I can't go more deeper
8 than that, but that's why they're different.

9 MR. FRANCO: Yeah, there's obviously
10 some sheets we didn't go to. But this is the
11 rebuttable payback sheet. Obviously that's --

12 MR. CYMBALSKY: Yeah, that's just a
13 different calculation, so.

14 MR. STANONIK: John, quick -- Frank
15 Stanonik, AHRI. A quick question. So when you're
16 looking at price forecasts, again, for any
17 analysis you're doing for rulemaking, do you do
18 any kind of a sensitivity analysis to say, well,
19 what if -- what if our forecast really changes by
20 x or y or --

21 MR. CYMBALSKY: Yes.

22 MR. STANONIK: You do? Okay.

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1 MR. CYMBALSKY: Okay. NIA, we have 45
2 minutes and so take it away.

3 MR. FRANCO: Great. Thank you. So now
4 let's go from -- transition from LCC to NIA. So
5 this is the sheet in the LCC that's kind of the --
6 one of the more important parameters for the NIA.
7 This is the LCC outputs. So we actually see a
8 copy of this in the LCC spreadsheet, and this will
9 be the some of the major economic parameters for
10 the LCC, for the NIA spreadsheet.

11 Let's just briefly go and see how this
12 is divided up. We divided it -- so sometimes in
13 some of these spreadsheets, it's just the national
14 results and those are what's being used as the
15 average results for national. Here we actually
16 divided them up into residential by region, south
17 or north, and replacement and new construction.
18 And so, the shipments that are new construction,
19 residential south have those inputs and the ones
20 that are different have different inputs and we're
21 also looking at commercial in the same new
22 construction, replacement in the same regions,

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1 south, north. Sometimes we label south as rest of
2 country and we have south but it really means rest
3 of country.

4 The inputs as we'll see are fuel use,
5 electricity use, so the energy use, the retail
6 price and installation cost, maintenance repair,
7 which is an annual value and the distribution. So
8 this is a base case distribution. So what this is
9 saying is that 78 percent of shipments in the
10 south are non-condensing for replacements and then
11 you go and you'll have a different value.

12 So that's looking at it as if there was
13 no switching. So those are the inputs as we're
14 doing switching. Now, if we want to look at the
15 switching input, those will -- there's actually
16 some -- before going to switching, there's a
17 couple other inputs that we actually -- that are
18 from the LCC. So the LCC calculates energy
19 prices. The energy prices is in 2012. It's the
20 average for the same regions. It's the south and
21 then whether it's new construction or replacement.
22 And these would be the values. So again, these

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1 are the average for those households.

2 Those are the inputs. Then we have
3 standby. I won't talk too much about that. And
4 then we have these what we're calling the
5 switching lookup tables. So this is what is the
6 impact of switching. This is kind of what's going
7 on to just the households that switch.

8 So let me go a little in detail about
9 what's happening here. So this is kind of the
10 differential of the what's going on between you
11 didn't switch and switched. So first level,
12 efficiency level zero means that it's just a non-
13 condensing. So there's no switching there. So
14 that's why we have zero impact throughout and
15 there's no -- there's a hundred percent. There's
16 no switching to any of this other equipment, so
17 zero, zero, zero, zero.

18 Now, if you go to the next one, let's
19 say we're going to 90 percent standard. So I
20 forgot to mention this is only looking at
21 households that are at 80 percent. So out of the
22 households that are starting at 80 percent in

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1 2021, 80 percent in replacements in the south
2 residential will not switch, 80 percent of those,
3 80.7. Those, the actual differential energy use
4 is this. They actually consume a little bit more
5 on average, a little bit more electricity. The
6 retail prices are a little bit -- installation and
7 repair retail prices are a little bit different
8 and the repair and maintenance a little bit
9 different. So these are the differentials that
10 occur.

11 Now, 5.8 percent actually switched to an
12 electric furnace and this is the impact of that.
13 So they consume 16 million Btus less. The
14 electricity use goes up obviously, or 4,477 and
15 then this is a retail and installation cost
16 differential and as well as a maintenance repair
17 differential. Now, let's go to the next one.
18 Heat pump, in this case it's 13.5, the same
19 situation for heat pump is more efficient. So you
20 see less electricity use. And then, we also
21 account for the difference between when you're
22 going from a gas water heater to an electric water

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1 heater. Let me just before going to that, so just
2 to emphasize this, 5.8 plus 13.5 plus 80.7 adds up
3 to 100 percent. So that's just a heating switching
4 fraction.

5 Now, when we're going to the water
6 heating, this is like a separate piece of it, 2.5
7 percent of households switch their water heaters
8 because of the standard in this case and these
9 would be the impacts. So again, they're obviously
10 consuming less fuel use and so gas or LPG and then
11 they're going to use a lot more electricity. So
12 and we repeat that for north, south, new
13 construction, replacements and those are fed into
14 the NIA.

15 So now, let's open up the NIA
16 spreadsheet and I'll -- let's see. I'll close
17 this. So I won't save it and I'll close it.

18 MR. M. HUNT: This is Marshall Hunt. So
19 that's total different spreadsheet?

20 MR. FRANCO: Yes, yes. Total different
21 spreadsheet. So if you go to the DOE website, the
22 LCC is one spreadsheet that you can download and

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1 then this is the NIA spreadsheet. So let me open
2 the NIA spreadsheet. And again, to emphasize, the
3 LCC spreadsheet is where you need Crystal Ball and
4 you're looking at these distributions. The NIA
5 spreadsheet, you don't. There's just this macro
6 that you have to run to be able to get the final
7 results. But you could just use Excel. There's
8 no separate add-on program.

9 Let's go starting with the structure.
10 So very similar to what we saw before with LCC.
11 We have the results here. The results are labeled
12 based on the different scenarios. These are
13 called trial standard labels here, the labeling
14 here and then there's different scenarios. And
15 the results are kind of the overall results but
16 then you can look at the regional results. So for
17 example, north and south results and if you add
18 those two up, you'll get the national results.

19 There's two sets of results. There's
20 the national energy savings and the net present
21 value. These are looking at outputs for when
22 you're running the macro and these are specific

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1 worksheets that are just pasted values.

2 MR. SCHROEDER: How do you get the data
3 form the LCC spreadsheet into this spreadsheet,
4 because it needs the output from that, right?

5 MR. FRANCO: Yeah, and I'll go through
6 that and that's a very important part, yes. Yes.
7 And if you want, so that's a very important point
8 and that's why I wanted to focus on the LCC
9 output. So for example, let's say something that
10 you really have to do if you want to change
11 something on the LCC and then see the impact in
12 the NIA, you would need to go through that process
13 of transferring those results into the NIA and
14 we'll go through that.

15 So again, we went through this a little
16 bit. There's some analysis parameters and those
17 are kind of fixed. Those are kind of set up based
18 on how DOE does its analysis and those are not
19 things that you should try to change. The things
20 that you can change pretty easily are the
21 scenarios. So you can change the economic growth
22 assumptions from AEO which changes the shipments

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1 and energy price trends and you can also change
2 the equipment price trends, which there was a
3 question about that. You can go to different
4 scenarios and you can change whether it has fuel
5 switching or not.

6 Those are the basic parameters that are
7 very easy to change. Now, something that as you
8 go through you can change other things. So for
9 example, the LCC output and we'll try to go
10 through that. And here are some of the
11 instructions to run. But basically, if you wanted
12 to generate new results, you would click here. It
13 goes through the process of going through each
14 region and it generates the final results. It
15 takes about -- and for example, about two to three
16 minutes. So it's much easier than the LCC. The
17 LCC takes a lot longer. So let's go and see. I
18 want to check how much time. Okay, we're perfect.

19 So since this is a few hours ago, a
20 reminder, there is a lot of different worksheets.
21 But the two primary worksheets are the non-
22 weatherized gas furnace one, this one labeled non

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1 -- NWGF and the mobile home. So gas furnace.

2 So these are the two main sheets that
3 everything is being calculated in, the shipments,
4 the inputs by year and the actual fuel switching
5 impacts. And those are the ones that we're going
6 to be spending more time on. But there are
7 individual sheets that there's some data that's
8 being picked up. So one of them is the LCC
9 output. Yes?

10 MR. ADROIT: Henri Adroit with Goodman.
11 I'm just having -- I'm receiving an error message,
12 a runtime error 1004. Can you explain that? It
13 says method range of objet global failed and it
14 gives me an option of either saying end or debug.

15 MR. FRANCO: We could look at that maybe
16 afterward. I'd need to look at it.

17 MR. ADROIT: Okay, thanks.

18 MR. FRANCO: So what we'll -- to answer
19 your question, the specific question about the LCC
20 output, now is a good time. So right now, it's
21 set up as being something that's manual, at least
22 inputted. But basically if you remember the LCC,

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1 this is the same setup. It's set up like the
2 south residential. These are the inputs. And
3 basically what you would need to do is you would
4 need to copy and paste those here in this gray
5 area.

6 So something important to note, you
7 would need to copy it here. And if you look,
8 these are fixed values. So you would just copy
9 the fixed values. The values up here are the
10 values that are being looked up for the specific
11 region and residential. So if you notice here, it
12 says north residential and it's picking up
13 residential results.

14 MR. LESLIE: This is in the I don't know
15 what to do about -- this is Neil Leslie, GTI. My
16 version of this same spreadsheet has number ref
17 all over the place in the rows 11 through 19
18 rather than the values you are showing in there.
19 Is there a way to get that taken care of?

20 MR. FRANCO: Of course, yes. I mean, it
21 might be that the published version, there was
22 accidentally one worksheet that was deleted which

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1 is the one that calculates. So this one we'll
2 publish right away. Yeah, so you can have that
3 version. Sorry about that, yeah. We thought we'd
4 corrected that but we'll correct that right away.

5 So that's important because you don't
6 want to paste the values directly in here unless
7 you wanted to do like a national average. Then
8 you would paste it in. You would paste those
9 vales below this gray area and you have to do it
10 appropriate, commercial, south, north,
11 replacement, new construction. And the other
12 parameters up here that you want to take care of
13 is these energy prices. Energy prices would
14 belong here that are coming from the LCC. So sadly
15 you don't have the instructions to do that. They
16 would be published together with some kind of
17 rulemaking. But yeah, you don't have them in the
18 spreadsheet. That might be something to add.

19 Then if you're interested in standby,
20 the standby results would be here. Now, the
21 switching table results are in a different
22 worksheet which is this one. And it's the same

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1 situation. You have these are the lookup values
2 that are specific and then below are the actual
3 values you want to copy and paste. You want to
4 make sure one thing is that you don't have
5 anything that looks strange. So anything that's
6 like a line or it produces an error. You don't
7 want to have it in here because when it does the
8 macro and it has like N/A here, it doesn't know
9 what to do with it. So you want to just take
10 those out when you're copying and pasting into
11 here because those are -- you're going from the
12 LCC and you're putting it into here. So hopefully
13 that explains how you would manage going from the
14 LCC to the NIA, the inputs.

15 Let me just briefly go to the other
16 inputs before going to the calculations. Almost
17 all the other worksheets are kind of trends that
18 are being occurred. So in the LCC, we're just
19 looking at everything that's occurring in 2021.
20 But obviously the shipments are for 2021, 2022,
21 '23. So the trends are basically from the inputs
22 that we're getting from the LCC. That would be

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1 our base year, and then how that varies for the
2 shipments in 2022, how that varies for 2023.

3 In this case, we're looking at the
4 equipment price trend. Now, obviously if you
5 change it to some other scenario, you'll get
6 different indices. Now, let's look at for example
7 the next one would be energy use trend. So the
8 2021 is your base year.

9 Then you have a different trend. Let's
10 say for example the fraction of condensing market
11 share. 2021 would be the base year which would be
12 these values and then you have some different
13 fraction in the subsequent years.

14 MR. LESLIE: Just as a general on this
15 particular spreadsheet, since we have not yet been
16 able to -- Neil Leslie, sorry. There are similar
17 issues with the number referencing around. I'm
18 hoping and assuming that when you put this up soon
19 that those e will have been taken care of along
20 with the way that we can actually use it, right?

21 MR. FRANCO: Of course, yes, yes.

22 MR. LESLIE: So we can really do that.

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1 Thank you.

2 MR. FRANCO: Yes, yes, yes. Of course,
3 very sorry about that.

4 MR. LESLIE: We did not want to bother
5 you with that right now. Our main focus was on
6 the LCC spreadsheet. But wanted to deal with that
7 at this discussion. Thank you.

8 MR. FRANCO: Thank you.

9 MR. M. HUNT: This is Marshall Hunt,
10 PG&E. IS there a particular person who we should
11 contact with these kinds of spreadsheet issues?
12 It might help to have -- okay, thank you, John --
13 a clearinghouse person. Thank you, John.

14 MR. FRANCO: Thank you. So let me just
15 go through a couple of these and then we'll just
16 focus on the NIA. So again, fuel prices or energy
17 prices. Again, there's a trend. So 2021, there's
18 a certain price and then there's different values
19 and that trend is being applied. Let me see.

20 There is a forecast of housing starts.
21 That's -- well, this is more in the realm of
22 shipments. So now we're getting to shipments. So

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1 in terms of shipments, there's some historical
2 data and there's other inputs. So as we go into
3 shipments, then these are the inputs. Lifetime in
4 terms of the retirement, those would be a
5 different set of assumptions here.

6 The end results of everything that's
7 going on are in some of these worksheets. So
8 we're not going to talk about these. But if you
9 clicked on here, these would be kind of the end
10 results. So if you're looking at the summary of
11 shipments of everything, maybe you would go into
12 here.

13 You would -- if you're looking at
14 something else, you might go into some of these
15 intermediate worksheets. So for example, some of
16 these actually produce the results that are being
17 shown in the summary. These are just like
18 outputted from the macro and these will change as
19 you change the spreadsheet assumptions. And these
20 -- some of these are populating in the NIA
21 summary.

22 So as you can see here, this one is

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1 using intermediate for NIA plus. So if you wanted
2 to understand where those values are coming from,
3 those are coming from there.

4 So that kind of summarizes how this
5 different worksheets. Now let's get into the
6 whole spreadsheet. So this is a little bit -- a
7 lot of information but hopefully we'll structure
8 it so it's easy to understand where things are
9 coming from. So the first part is we have inputs,
10 different inputs that are coming from different
11 parts. The first part of the inputs are more
12 related to the economic and energy use.

13 So for example, this is just looking up
14 at 2021 for the northern region. So again, this
15 is divided by region, north and for the sector
16 residential. What would be the inputs in 2021?
17 So efficiency level one, 80 percent efficiency.
18 This is the annual fuel use, the electricity use,
19 the retail price, installation cost, repair cost
20 and then this is the base case efficiency. So
21 that's just for 2021. And after that, you're
22 projecting, after that period.

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1 As part of the shipments analysis, you
2 have some imported values. And what this gives us
3 is mainly the fraction of demolitions, so houses
4 that are not being replaced. So that kind of
5 decreases the number of replacements and number of
6 households that potentially could be new owners.
7 So this is the primary purpose of the calculations
8 going on in here.

9 So let's go into the main calculations
10 sheet. So starting column T all the way to, well,
11 there's a couple of -- let's see, column T to I'd
12 say DD, this column right here. All the
13 calculations that are here are related to the base
14 case. So the current -- if there's no minimum
15 standard. So the shipment, all the inputs, so
16 that's like your baseline, you're calculating the
17 base case.

18 The next set of calculations are related
19 to the standard cases. And when you're looking at
20 the spreadsheet, you have to understand that it's
21 only looking at one of the standards that you're
22 looking. So you'd have to change -- if you wanted

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1 to look at a specific standard case, you would
2 have to change. For example, instead of 90
3 percent, you want to see three results for 92 for
4 the north, replacement. You'd have to change the
5 variables to see that. In this case, it's just
6 looking at 90 percent.

7 And these are all the -- and we'll go
8 through a little bit what these columns mean. So
9 that's how that's divided up. Now, at the very
10 end, there's a standby which is a different area
11 of this. And then there's the equipment switching.
12 And so, the equipment switching, kind of the new
13 shipments that are going to electric equipment or
14 electric wiring equipment are being calculated
15 here and the impacts and then they're being brought
16 back into the main calculation. So that's kind of
17 the three areas.

18 So in terms of if you wanted to change
19 some of the assumptions, it might not be -- you
20 would probably want to change the assumption, for
21 example, on the LCC outputs, do different outputs
22 you want to change some of the trends in the other

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1 sheets. Here, it's more the actual calculation.
2 So it's I'll go through it but it might be a
3 little bit more difficult to change the
4 assumptions here. But let's walk through it a
5 little bit.

6 So again, this is just for -- I believe
7 this is north residential. We're only looking at
8 north residential. So we go through and
9 calculate. First we look at the historical
10 shipments. And for that area of the country,
11 these are the actual historical shipments that are
12 being picked up in that worksheet, historical
13 shipment for the north residential. Then at a
14 certain point after 2013, that's the last year we
15 have historical shipments, we start projecting our
16 shipments. These are the projections. So by 2021,
17 we're projecting that 1.659 million shipments
18 would go to the north residential.

19 How is that constructed? So it's very
20 similar for all rulemakings. Usually there are at
21 least two components, but sometimes three to the
22 shipments model. The main components are the new

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1 construction market and the replacements. But
2 then you have either new owners or early
3 replacements. You have some other things that are
4 going on in the market. So we actually for this
5 analysis we have three. And basically we have new
6 construction which is labeled new units. We have
7 new owners or our understanding what new owners,
8 the difference, and the replacements. And those
9 three inputs if you add these three up, will give
10 you 1.659.

11 So each one of those has different set
12 of assumptions. Let's briefly go into where some
13 of this data comes from. So basically new units
14 basically it's how many housing -- how much new
15 housing is occurring in a country and how often
16 that's a gas furnace, for example. And so, it's
17 basically that situation. Let's say for example
18 in the north it's 60 percent of new construction
19 is gas furnaces, times the number of new
20 construction. So that gives you this number, 352.
21 So that's basically what's occurring there.

22 Next part is replacements. Basically

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1 replacements, we have remember the lifetime. From
2 the lifetime you can get kind of a retirement
3 factor because our lifetime is based on
4 distribution. So then, that gives us a sense of
5 how many units are being replaced. Now, in here
6 we also take into account households that are
7 being demolished. So there's some households that
8 are being replaced but there's also some
9 households that are being demolished and no longer
10 replaced. They're something that's occurring in
11 the market.

12 So this gives -- this takes that into
13 account as well. And then based on the
14 information that's available, we make what
15 fraction of new owners are in the market and that
16 -- the total of these three is what gives us again
17 the 1.659. Now, if you kind of go merge
18 replacements and new owners, this is the fraction
19 in the north. This would be the new units for
20 that specific year, 2021. This is again the north
21 replacements. This is actually accounting for the
22 stock that's being installed and how the stock

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1 increases. It's just for visual purposes. The
2 main result is the shipments here, 1.659.

3 So now based on that let's just go into
4 the energy use and the other inputs, the equipment
5 cost, the installation cost and how that's being
6 used. So basically, the energy use components are
7 divided up into replacements, new units and those
8 inputs again are coming up from here. So let's go
9 back here. It's probably easier to go here and
10 see.

11 So what we're saying is that these
12 inputs, 33 percent of the time or 33 percent of
13 shipments in 2021 are 54 million Btus, 6 percent
14 are at 48 because they're already 98 condensing,
15 16, 47, 45. So if you sum product, this and this,
16 that gives you the weighted -- shipment-weighted
17 energy use for 2021 and that's your base case. So
18 once we talk about standard case, obviously you're
19 not going to have this first row and then
20 everything either ships or rolls up or something
21 happens to it and you could have different
22 distribution of your shipments.

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1 After 2021, then we get into -- well,
2 maybe the energy use changes or something happens.
3 So then there's a trend that's being multiplied.
4 So 2021 is just based on LCC but then after that
5 there might be some other inputs and then the
6 energy use changes after that period. And you can
7 kind of see that there's some changes here and let
8 me just point out two of those changes.

9 So one of them, the primary one is that
10 there is a base case efficiency transfer. So
11 there's a trend of how many households are
12 condensing furnace. So originally, maybe this is
13 60 percent of the furnaces are at 90 percent or
14 above. But then the next year it'll keep growing.
15 So historically there's been the trend going
16 towards condensing. So we follow that trend.
17 Then there are also efficiency trends. So for
18 example, the building shell or how households are
19 built is they're built better, more robustly and
20 those are also an input and that also decreases
21 the energy use over time. So as you can see, the
22 energy use even at the base case decreases over

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1 time. So that's that part.

2 Now, let's go to the last few
3 components, the equipment cost and installation
4 just as this is both. The same thing happens
5 here. We add up the installation and repair. We
6 multiply it times the fraction that's occurring.
7 There's only a minor detail here is you're
8 multiplying this times the base case, this times
9 the base case and adding up together. But for the
10 retail price, there's a trend. So for that, for
11 only the retail price, there's in the case - - in
12 the reference case here there's a decreasing trend
13 in the price. So that's the only difference. And
14 assuming that installation cost is fixed.

15 So now let's go to maintenance and
16 repair. The same thing occurs and as we discussed,
17 you're multiplying. So it's shipment-weighted.
18 The only difference here, as you can see, there's
19 a difference in the price, is based -- this is
20 only based on because there's going to be more
21 condensing fraction. So we're almost done. So
22 now, what we want to do is kind of aggregate all

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1 that and get the operating cost and get the total
2 installed cost to calculate either the national
3 energy savings or the net present value.

4 So calculate the national energy
5 savings, obviously we only need the energy use.
6 And so, we kind of tally up the energy use which
7 is essentially the per unit energy use that we
8 were discussing before, this, either the fuel or
9 the electricity times the shipment. So basically
10 if it's new, for example, here we're multiplying
11 the 343 number times the million units and then
12 the fuel, the same or to the replacement new
13 owners. And that will give us these final
14 numbers which are the -- so that's why this is in
15 quads. Oh no, I went too far. Sorry.

16 Let's see. There we go. So this is
17 still base case. So these are the quads that are
18 for the energy use. Then the equipment costs are
19 the same. So this is again retail and
20 installation, total installed cost. Those per
21 unit times the number of shipments. So this deals
22 with the NES. Now, when we get to the NPV, we

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1 also want to calculate the operating cost. So the
2 operating cost, obviously you have to multiply the
3 energy use, these totals, times the fuel price or
4 electricity price. And you pick up the
5 appropriate values. You multiply them and you get
6 these results. And that basically those are the
7 final results to if you add these all up.

8 So this is 2021. You go all the way
9 down. If you're only looking at equipment costs,
10 it only goes to 2050 because you're only
11 purchasing up to 2050. But then if you're looking
12 at operating or energy use, you have to wait until
13 the end of the last unit and so then that goes
14 beyond that. And that kind of summarizes the base
15 case. But what you want to do really is compare
16 your base case to your standards case.

17 So before there's switching, before
18 taking into account switching, here the standards
19 case, the shipments are the same. So this is
20 without asking into account switching. So if you
21 compare the shipments here to the shipment before,
22 they're exactly the same. And the inputs are

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1 dependent on what you're looking up in terms of
2 the standard. So your starting point will be
3 different. So instead of taking into account this
4 line here, if you're looking at the standard level
5 two here, 90 percent, then you're only multiplying
6 these and these and then depending on what
7 product, it might be that it's the 33 is rolled up
8 or there's kind of a shift that's occurring.

9 And so that very product specific even
10 energy level if there might be some other
11 assumptions that are going on there. And then,
12 that's how those per unit costs are being
13 generated. The same thing occurs then when you're
14 trying to account for the national energy use
15 which would be these and then the equipment cost.

16 Then so because we're looking -- we want
17 to do the savings. So that's the interesting --
18 that's where the interesting aspect of looking at
19 this is looking at comparing the base case to the
20 standards case. And this is where it's basically a
21 differential between the standards case results
22 and the base case results. This is where this is

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1 being calculated and you get energy savings or
2 operating costs. You add those all up to 30
3 years. There's some discounting based on whether
4 you're using a 3 percent discount or a 7 percent
5 discount rate. That is also accounted for.

6 The macro -- one of the other things
7 that the macro does is other than just doing this
8 north, south and replacement/non-replacement,
9 commercial/residential, it also takes into account
10 whether it's 7 percent or 3 percent discount rate.
11 So it does all that in that macro.

12 MR. M. HUNT: Victor, this is Marshall
13 Hunt. We selected the standards case way back on
14 column FM I think. Is that true?

15 MR. FRANCO: Yes. YES, yes. So this is
16 T is base case, starting the base case inputs.

17 MR. M. HUNT: Okay, T.

18 MR. FRANCO: And then the actual kind of
19 results are being kind of the aggregated results
20 of all shipments are this part.

21 MR. M. HUNT: FM-4 and it's appeared
22 other places. That's a scenario we're looking at,

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1 right? That's the efficiency level?

2 MR. FRANCO: This is FM-4. Oh, don't
3 actually know what that means. I don't know.
4 That's just a one.

5 MR. M. HUNT: So but you have to run
6 different runs to select the different test
7 standards levels, correct?

8 MR. FRANCO: Yes, correct. Correct.

9 MR. M. HUNT: And that's selected where?
10 Is that way over?

11 MR. FRANCO: It's actually selected in a
12 different sheet.

13 MR. M. HUNT: Oh, okay.

14 MR. FRANCO: Yeah, and we can go there.
15 Just one second.

16 MR. M. HUNT: Way over there.

17 MR. FRANCO: Yeah. So we'll get to that
18 to change. Yeah, no that's important because if
19 you wanted to look at different assumptions
20 obviously. So that's kind of that's how that's
21 set up. And this is what the output of the
22 results that you're getting at the very end. So

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1 if you wanted to look at for that specific and
2 what's going on, how this adds, disaggregating
3 electricity and gas and looking at the different
4 details, this would be the place.

5 Now, this also accounts for fuel
6 switching. So now what we'll talk about the fuel
7 switching component and now it interacts in here.
8 so if there - - if you select that you're doing
9 fuel switching, which right now it's defaulted to
10 fuel switching, then it will pick up those results
11 and then put them in there in the standards case.
12 So let's take a look at the fuel switching
13 component. Okay, so we're not going to be talking
14 about standby. But if you're interested in
15 standby, this is where the results would be
16 calculated.

17 Let's go to equipment switching. So
18 equipment switching is somewhat similar.
19 Essentially what you want to do is you want it to
20 calculate how many homes are getting impacted and
21 what would be kind of the differential impact. So
22 for the homes impacted in terms of non-

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1 weatherized, they would be here. So I'm just
2 going to kind of go through the structure first
3 and then it depends if it's a replacement or a
4 new. Then if it's electric furnaces, this would
5 be kind of the place that would play into. Heat
6 pump and then electric water heaters.

7 And as you can see, everything is
8 replacement, new, that's being calculated and the
9 aggregated results kind of are towards the end
10 where you have quads and thousand million watt-
11 hours and you have the equipment cost and
12 maintenance repair cost. And that's kind of --
13 this is the setup.

14 Okay, so we have five minutes. So we'll
15 go really quickly and hopefully I have more than a
16 couple minutes to any questions. So let's see how
17 to summarize this. Basically, there's a lot
18 obviously to talk about here, a lot of details.
19 So remember we were looking at what the fraction
20 would be that switched.

21 So this is the fraction that would be at
22 non-weatherized gas furnaces in 2021, 85 percent,

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1 73 percent of the replacements and new. So
2 remember we have the fractions are different
3 between new construction and replacements. And
4 so, those would be the ones that don't switch,
5 right? Those would go to non-weatherized gas
6 furnaces. Then if you go to electric furnaces,
7 then these are the fractions, 3.5, 7.5. Then if
8 you go to heat pump, these would be the fractions.

9 And again we're looking at replacement,
10 residential, residential north results. Okay, so
11 those would be the fraction of shipments that
12 would be impacted. Before that, the actual number
13 of shipments that are impacted depends on the
14 fraction of non- condensing. So the total number
15 of shipments and replacements is this number. The
16 total number of new is this number.

17 So if you recall, if you add these two
18 up, that's the total number of shipments. Then 33
19 percent of those are non-condensing. So those are
20 the ones that are impacted. So that's 520,000
21 replacements. And -- oh stop, let me correct that
22 error, and then 35 percent of this number would be

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1 the new construction. And of those, of the 35
2 percent times this, 85 percent or 73 percent of
3 those would go to non-weatherized gas furnaces.
4 So hopefully the accounting more or less you
5 understand more or less. So for example, let's go
6 here.

7 So if you multiply those fractions, 73
8 or 85 depending on replacement or new
9 construction, you get -- you end up with this
10 number for replacements or this number for new
11 construction. So those are the ones that are
12 switching to non-weatherized gas furnaces and the
13 ones that aren't impacted. And then, you have the
14 same for electric and the same for heat pump. So
15 11 percent times all those fractions and you get
16 these are the actual impacted replacements and
17 impacted new construction.

18 The rest is similar to before.
19 It's just looking at the switching, the switching
20 impacts, how much as. So for example, because
21 you're decreasing your gas use by switching,
22 there's a negative impact. And because you're

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1 increasing your electricity usage, increased
2 electricity use. That then is inputted into the
3 standards case cost and is a part of the energy
4 savings or equipment and operating costs. And I
5 think that's about it. There's more details but
6 I'm kind of --

7 MR. CYMBALSKY: Why don't you show
8 Marshall where you have to specify what standard
9 level?

10 MR. FRANCO: Oh, yes, yes. That's it.

11 MR. CYMBALSKY: Because I think that's
12 important for everybody.

13 MR. FRANCO: That is very important,
14 yeah. So there's this sheet at the end that's
15 called summary of results. And here there is
16 what's called TSL. So there's going to be two
17 things that you need to consider when you're doing
18 this. So usually what DOE does is you have the
19 trial standard levels and you have different
20 efficiencies that are associated.

21 So you go to summary results. If you
22 want to change this manually, you can. There's no

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1 problem with doing that. So let's say we want to
2 look at TSL 1 and we change it there. The results
3 will change. Here's some kind of like preliminary
4 results that are just the addition of the numbers
5 and you can actually see --

6 MR. M. HUNT: That's what's left?

7 MR. FRANCO: Yeah.

8 MR. M. HUNT: And you run them one at a
9 time?

10 MR. FRANCO: If you wanted to go one at
11 a time. Yeah, yeah, you could just go and then
12 two and see how the results here are going to be
13 changing depending on the region? Right now we're
14 in the north. So it depends on there it's going
15 to be changing the impact.

16 UNIDENTIFIED MALE: (Off mic.)

17 MR. M. HUNT: Magic physics.

18 UNIDENTIFIED MALE: A hundred and ten
19 percent efficiency.

20 MR. FRANCO: Now, if you wanted to
21 change -- you wanted to look residential
22 commercial, you would change it here in this other

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1 one which is called labels. And I just also
2 wanted to point in the labels, you can see the
3 mapping of the trial standard levels to the
4 efficiency levels. So for example, what does TSL
5 1 mean? So then here you would see that TSL 1
6 means this, efficiency level one, efficiency level
7 one or two and three and two because this is in
8 the northern region.

9 And it might change between the north
10 and the south because you could have regional
11 standards as well. So this is where you would go
12 and maybe change -- maybe you want to have a
13 different combination. This is where you could
14 change that.

15 MR. CYMBALSKY: Okay, so this is where
16 you can cook up your own standard. Okay, so it's
17 12:58 and we have a hard stop unfortunately. And
18 so I just want to end here and thank everybody for
19 coming. We do have a parting gift for all of you
20 who've stayed. On your way out, there'll be a
21 shopping basket full of printouts from the
22 meeting. It's mostly screenshots of what Victor

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1 went through.

2 But I know some people would prefer to
3 have a hard copy. We didn't want to hand them out
4 at the meeting because I really think it's better
5 that you focus on what he's talking about and
6 where he's talking about it as opposed to flipping
7 through sheets. But please pick one up on the way
8 out. Again, if there is a follow-on that, you
9 know, we need to come back and do some more of
10 this, we're open to that. So feel free to
11 request.

12 As for the questions, we mentioned that
13 the questions that were sent in prior to the
14 meeting. I went through the list and I'm pretty
15 sure we answered all of those that we could as we
16 went through the meeting. So if you feel that
17 there were questions that weren't answered, you
18 know, just get back to me and we'll see how we'll
19 handle that. But I think I just went through the
20 list of them and I think the ones that we were
21 able to answer, Victor went through in his work
22 and kind of pointed them out. So --

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1 MR. MILLER: This is Bud miller and
2 speaking I think now for APGA and AGA, we
3 appreciate the tutorial. This is not really the
4 meeting we had asked for or planned for or
5 anticipated and unfortunately many of the
6 questions that we submitted have not been
7 answered. But it's my understanding, and correct
8 me if I'm wrong, that when the proposed rule does
9 issue, we'll get the answers to those questions
10 that we feel have not been answered today and
11 there are many of those frankly.

12 MR. CYMBALSKY: That's right. And so, I
13 think, you know, there are 20-some odd questions
14 and I think only maybe half a dozen or a little
15 more than that we consider that we answered. So
16 yes, at the NOPR meeting would be the more
17 opportune time to ask the questions that were
18 specific to assumptions and the numbers that are
19 in the spreadsheet.

20 MR. MILLER: And would you anticipate
21 that would be held within what, x days after the
22 proposed rule issues? When would you anticipate

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1 that to be held?

2 MR. CYMBALSKY: Right. So for the NOPR,
3 there will be a 90-day comment period as agreed to
4 in a settlement. We will choose a day within the
5 90-day comment period, maybe in the middle. I
6 don't know if you have a preference. Do you want
7 it in the beginning or the end? That's --

8 MR. MILLER: I would think sooner rather
9 than later. I mean, there may be a need for more
10 than one meeting. But these basic questions that
11 we needed answered were to get as much
12 understanding of the spreadsheets as possible as
13 early as possible. So I think we would like the
14 initial meeting to be early in that comment period
15 and there may be a need for subsequent meetings
16 and we hope you're open to that as well.

17 MR. CYMBALSKY: Okay. Well, we'll think
18 about that. I mean, the caution there is you'll
19 need time to actually digest the NOPR. So I think
20 that's most stakeholders need, as I've heard from
21 everyone, lots of time to digest it.

22 So we hope that by putting out these

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1 analytical tools ahead of time we're giving you a
2 running start on what the data look like and also
3 we hope that this meeting was helpful in that you
4 can go back now and play with the spreadsheets and
5 have a better understating of how the analysis
6 works.

7 So that was the intent of this meeting.
8 I know people wanted more information about the
9 proposal. But that's simply just not possible for
10 DOE to do at this time. And again, at the NOPR
11 stage, we will be obviously entertaining those
12 types of questions. So thanks everyone for
13 coming, and I hope you did gain some knowledge of
14 the spreadsheets because that certainly was our
15 intent. Travel safe. Thanks.

16 (Whereupon, the foregoing adjourned.)

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1 CERTIFICATE OF NOTARY PUBLIC

2 I, CHAZ BENNETT, the officer before whom the
3 foregoing deposition was taken, do hereby certify
4 that the witness whose testimony appears in the
5 foregoing deposition was duly sworn by me; that
6 the testimony of said witness was recorded by me
7 and thereafter reduced to typewriting under my
8 direction; that said deposition is a true record
9 of the testimony given by said witness; that I am
10 neither counsel for, related to, nor employed by
11 any of the parties to the action in which this
12 deposition was taken; and, further, that I am not
13 a relative or employee of any counsel or attorney
14 employed by the parties hereto, nor financially or
15 otherwise interested in the outcome of this
16 action.

17

18

19

20

21

22



CHAZ BENNETT
Notary Public in and for the
Commonwealth of Virginia

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1 CERTIFICATE OF TRANSCRIPTION

2

3

4 I, BENJAMIN GRAHAM, hereby certify that I am not

5 the Court Reporter who reported the following

6 proceeding and that I have typed the transcript of

7 this proceeding using the Court Reporter's notes

8 and recordings. The foregoing/attached transcript

9 is a true, correct, and complete transcription of

10 said proceeding.

11

12

13

14

November 12, 2014

15

Date



Benjamin Graham

Transcriptionist

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