UNITED STATES DEPARTMENT OF ENERGY

ENERGY EFFICIENCY AND RENEWABLE ENERGY
OFFICE OF BUILDING TECHNOLOGIES

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ASRAC FANS AND BLOWERS :
WORKING GROUP MEETING :
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A meeting in the above-entitled matter was held on Thursday, June 4, 2015, commencing at 8:10 a.m., at 950 L'Enfant Plaza, Seventh Floor, Room 7140, Washington, D.C. 20585-0121.

P R O C E E D I N G S

MR. BOSWELL: So it's a little bit after 8:00 and we're going to go ahead and get started. And welcome to Day 6 of the ASRAC Working Group on Fans.

For the record, we're going to go ahead and have everyone introduce themselves like we did yesterday. After we do that, Wade Smith is going to give the presentation that we did not get to yesterday on definitions.

Just for kind housekeeping, again if when you'd speak if you'd remember to say your name for the record that would be great.

We, as part of the ground rules we established, we're not reserving separate time for public comments. The people that are here from the public are able to speak as we go through the day. Also, for those on the WebEx, the committee members --

IT SPECIALIST: They're not actually dialed in yet.

MR. BOSWELL: -- oh, do you want to go ahead and, sorry.

IT SPECIALIST: Yeah.

[WebEx call initiated.]

MR. BOSWELL: Okay, so I think we're now connected to the web. As I was saying, as part of our ground rules here we decided that comments from the public would be accepted during the course of the meetings. If people are participating by webinar, there are three working group members on the webinar. They will hopefully all have open mics today. I know Greg Wagner had problems with that yesterday.

If there are other people from the public with comments, they can send a message to the web facilitator who will deliver that message to us in the room.

So, like we did yesterday, I'm going to ask if everyone could identify themselves by name and organization, starting with the far corner there and going around the room.

MR. MAGILL: John Magill with Howden.

MR. BOTELER: Rob Boteler, Nidec Motor Corporation.

MR. MCCABE: Michael McCabe, Consultant with Trane.

MR. ERNST: Skip Ernst, Daikin Applied.

MR. TEAKELL: Kevin Teakell, AAON.

MR. DYGERT: Ryan Dygert, Carrier.

MR. STEVENS: Mark Stevens, Air Movement and Control Association.

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

MR. FLY: Mark Fly, AAON.

MR. WHITWELL: Bob Whitwell, Carrier.

MR. MCNEIL: Don McNeil, Buffalo Air Handling.

MR. LIN: Paul Lin with Regal Beloit, representing NEMA (phonetic sp.).

MR. DELANEY: Dan Delaney, Regal Beloit.

MR. JOHNSON: David Johnson with Berner International.

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

MR. DIKEMAN: Steve Dikeman with AcoustiFLO.

MR. FERNSTROM: Gary Fernstrom with the longest introduction, representing the California Investor Owned Utilities, Pacific Gas & Electric, Southern California Edison San Diego Gas & Electric, a Southern California Gas Company.

MR. STARR: Louis Starr, Northwest Energy Efficiency Alliance.

MR. SMITH: Wade Smith with the Air Movement and Control Association.

MR. BURDICK: Larry Burdick, SPX Cooling Technologies, representing Cooling Technology Institute.

MR. HAUER: Armin Hauer, ebm-papst, Incorporated.

MR. DADDIS: Duane Daddis, Carrier.

MR. BUBLITZ: Mark Bublitz, The New York Blower Company.

MR. HOWE: Nick Howe, Carnes Company.

MR. PERSFUL: Trinity Persful, Twin City Fans.

MR. WOLF: Mike Wolf, Greenheck.

MR. ROY: Aniruddh Roy, Goodman.

MS. IYAMA: Sanaee Iyama, Lawrence Berkeley National Laboratory.

MR. JASINSKI: Sam Jasinski, Navigant Consulting.

MR. WIGGINS: Steve Wiggins, Newcomb & Boyd.

MR. SMILEY: Bill Smiley, Trane.

MR. CATANIA: Tom Catania, also for the Air Movement and Control Association.

MR. MATHSON: Tim Mathson, Greenheck.

MR. FINE: Steve Fine, Office of Hearings and Appeals.

MR. BOSWELL: Wade Boswell with DOE's Office of Hearings and Appeals.

MS. PONTILLO: Pam Pontillo, Department of Energy, Office of Hearings and Appeals.

MR. BOSWELL: Okay and Pete and John are here. If you could just introduce yourselves.

MR. COCHRAN: Pete Cochran, DOE.

MR. CYMBALSKY: John Cymbalsky, DOE.

MR. BOSWELL: And for the Committee Working Group members that are online, if you could introduce yourselves.

MR. WAGNER: Greg Wagner, Morrison Products.

MS. WALTNER: Meg Waltner, NRDC.

MR. BOSWELL: And is Diane Jakobs online?

Okay, so where we're going to start this morning Wade Smith is going to give his presentation on definitions that we had not quite gotten to yesterday. So we talked about that being the starting point.

John, do you have any comments that you wanted to make before we get started?

MR. CYMBALSKY: No, that's my understanding as well.

MR. BOSWELL: Okay, great. So, Wade the floor is yours.

MR. SMITH: Okay, so this is a file which was sent to the, included with the minutes for today's meeting. And it's, when you deal with definitions, you deal at a very detailed level and you have to think very, very carefully about the intent and the expectation, loopholes, things like that.

So I think the way to go through this with the group is to invite your questions, and a modest level of discussion, but I think it would be far better if you had a chance to study this document after the, after the meeting and prepare, if you see concerns, or you have problems or you want to make changes to try to bring those to the surface at that time, because getting to this point has been lots of committees working for many, many, many hours. Days really.

And this started back and forth between ASRAC and the efficiency advocates; Meg Waltner, who is on the phone, as the lead person for the group that worked on it. And at AMCA, we ran this through our Fan Engineering Committee.

And so I'm going to read these and this is an iteration of the framework document, the advocate proposal, the AMCA proposed changes, comments and concerns, DOE proposal that appears in the ASRAC, and the question that was answered last week actually by the Fan Engineering Committee.

So these essentially came through this working group and ended up with questions, you know, in this case, are you okay with the new DOE definition of Fan Committee responses. Yes, so that definition is a fan is a rotary-bladed machine used to convert power, meaning flying power to air power with an energy output limited to 25 kilojoules per kilogram of air, typically consisting of an impeller, a shaft, bearings, a structure or housing and transmission and driver, transmission driver and controls, if included by the manufacturer at the time of sale.

So --

MR. BURDICK: Wade, do you want comments on this now or do you want --

MR. SMITH: Sure, why not?

MR. BURDICK: Okay, well one of the things that -- oh, Larry Burdick, SPX, and one of the things that was commented on by one of my colleagues on this particular definition was that bearing, structure or housing, after that we put separately testable. You know, this maybe implies that you're going to test it, you know, in the housing or in the embedded configuration.

MR. SMITH: Could I ask someone to take notes? So if you want to just throw that, throw that out there.

MR. BURDICK: Yeah, and I can email that to you, too, Mark or Wade.

MR. FERNSTROM: So this is Gary for the California IOU's. What you have in the definition so far is clearly identifiable as part of the piece of equipment as offered for sale by the manufacturer. If separately testable is a judgment, and I think introduces some uncertainty or a little less confidence in the definition.

MR. MCNEIL: Don McNeil, do you think this is going to become our testable configuration when we refer to fans?

MR. SMITH: Yes. I think when we refer to fans this is the definition that will apply.

MR. MCNEIL: Testable.

MR. SMITH: Well, I think if you want to make, if there was a statement in the regulation that talks about testable configuration of a fan. So, you know, you know, can you make a case that there's a subset of this structure, a subset of impeller, shaft, bearings and structure, or housing, testable, that's an argument that could be made. This is a fan. Okay?

MS. WALTNER: This is Meg. Wouldn't the testable configuration be defined in the test procedure? I guess that's a question for John who is actually not here yet.

MR. SMITH: John is here.

MR. CYMBALSKY: I'm here but that's not a question for me. Honestly, I don't manage the test procedure part of the program.

MR. SMITH: Yes.

MR. CYMBALSKY: So the answer is yes, Meg.

MS. WALTNER: Thanks.

MR. SMITH: So what was your question again?

MS. WALTNER: So we were talking about the testable configuration. I don't think that's something we need to deal with in the definition of a fan. That seems like a test procedure question not sort of a fundamental definition of what is a fan as a covered product.

MR. FERNSTROM: So Meg, this is Gary. If I could follow along, I recognize the concern and the interest of some in the group of wanting to add that, but I agree with you, that issue ought to come up under testable configuration and not under the definition.

MR. SMITH: Dan, go ahead.

MR. DELANEY: So one question, I know we had -- Dan Delaney, Regal. One question we had, we discussed the driver definition and we talked about, oh, do we really want to get into the engine or steam control. Did we decide those are still viable, that a fan would be that? Or did we want to change driver just to say electric motor?

MR. BUBLITZ: Mark Bublitz, I do not believe we said electric motor. There were questions about being connected to the grid.

MR. DELANEY: We didn't take it off the table, did we?

MR. FERNSTROM: Well, whether it were measuring the shaft brake horsepower or the electrical input depends upon whether this product is sold with a motor or not. And if it's not sold with a motor --

MR. SMITH: Or whether there is gas in the engine.

MR. FERNSTROM: Well, I think early on in the discussion between you and the advocates we felt that market share of engine-driven fans was small enough we didn’t need to deal with that. Thinking about what the Edison Electric Institute would have to say, I think they would want to include natural gas pipeline-supplied engines in the mix, but I don't think they would care about fuel engines because they're concerned about the gas versus electric implications of this.

MR. SMITH: So in the marketplace they are varied in the 100 to 200 horsepower range. There are very few fans driven by anything other than electric motor. And in the discussions that we had with the advocates, there was generally agreement around the table to restrict the regulation to grid-connected electric-driven fans. And the reason I use grid-connected is because we have electric-driven fans that are in locomotive engines that are used on trains. We have other electric-driven fans that are not grid-connected.

MR. FERNSTROM: But again, this is Gary, we want to be sure to accommodate the situation where we have a bare shaft fan.

MR. SMITH: Yes.

MR. FERNSTROM: And that's what's being tested. So if a motor is included it's probably going to be an electric motor. And if it isn't, there's probably some good reason why it isn't.

MR. SMITH: Well, the question on the table is do we want to change the word driver to electric motor?

MR. FERNSTROM: I think we need to leave it driver to accommodate the situation where we're looking for the shaft horsepower.

MR. WHITWELL: I'm sorry. Yeah, this is Bob Whitwell. Carrier, United Technologies, and Sikorsky helicopter, and Pratt and Whitney jet engines, which maybe are considered fans, I don't know. But I think we should limit it to electric on the grid.

MR. SMITH: So the helicopter fan is not included.

MR. WHITWELL: Nor the tail rotor, nor the fan in the jet engine.

MR. MAGILL: John Magill, I’m on the fan committee. If I remember correctly, there is a definition much further down the spreadsheet.

MR. DELANEY: There is a possible -- it was proposed.

COURT REPORTER: I can't hear you.

MR. DELANEY: There was a proposal, the driver definition. It was in the original meeting. It included the IC engine.

MR. DIKEMAN: We haven't gotten to the driver.

MR. DELANEY: Driver is on line 52.

MR. DIKEMAN: No, I mean on Wade's thing up here.

MR. DELANEY: No.

MR. SMITH: Mark?

MR. BUBLITZ: A question for the regulation experts. If you define a fan, do you need to, I mean can't we put the driver part in the scope definition? Does it have to be in the definition of the product?

MR. DIKEMAN: Driver is coming up after impeller, isn't it?

MR. SMILEY: Well, Bill Smiley, Trane. Driver is down at the bottom of Wade's spreadsheet and it includes every potential driving mechanism, except windmills, which you could possibly imagine. But I think your committee said they weren't ready to address anything except electric motors, and I assume they mean connected to the grid because that's the whole purpose of what we're trying to do here.

MR. SMITH: Well, do you want to take a thumbs on that?

MR. JASINSKI: So Wade, really quickly before we do that, just to put this, maybe make this conversation more efficient. I don't think that this conversation is applicable to that DOE proposed definition that you have up there. That definition is a part of the authority discussion that we were having yesterday, and if you remember from the first meeting, Ashley in DOE said that the definition itself is going to be kept broad, the definition of a fan, the overarching definition of a fan.

MR. SMITH: When we were talking about scope of coverage?

MR. JASINSKI: We were talking about scope of coverage. So we want to start making a list that says scope of coverage, this is in and this is out, which this working group wants to set standards, that is perfectly fine. But I would say, for the most part, it is not, it is not that useful to try to tweak that definition any more than it's already been tweaked. I think it's better to make a list of the things that the group wants in and what the group wants out, which is what it sounds like the group is discussing here.

MR. MCCABE: Michael McCabe, one thing to point out is that the fans, as listed in the legislation fall in the section that deals with commercial and industrial buildings. So that does limit what is covered.

MR. CYMBALSKY: I think we're going to keep, you know, we're going to keep this definition broad and I agree with Sam. Let's move forward with scope at the appropriate time.

MR. SMITH: Okay.

MR. SMILEY: Bill Smiley, Trane, so does that mean we're going to keep a what's in-what's out list, or we're not going to keep a what's in-what's out list?

MR. CYMBALSKY: Well, that's part of the negotiations, right?

MR. SMITH: We should keep a list.

MR. SMILEY: We should keep a what's in-what's out list?

MR. SMITH: Yes, Mr. Bublitz has agreed to --

MR. BUBLITZ: I am logging that.

MS. MAUER: This is Joanna Mauer. Wait, how do you know the fan is going to be grid-connected?

MR. SMITH: So you don't. So the fan which -- well, a fan, this definition you don't know and don't care.

MS. MAUER: Right, in terms of the --

MR. SMITH: But later on when we talk about scope, if the fan is made and it's got a motor attached, then if that motor is obviously a grid-connected motor, it doesn't matter whether it's attached to the grid, it's covered because the fan is covered. It's capable of being connected to the grid.

MR. FERNSTROM: Well, this is Gary.

MR. SMITH: Let me, let me just say this. A fan which is shifted with a bare shaft, certified with a bare shaft, you also don't know, like clearly a bare shaft fan can be grid connected. Therefore, it would be covered.

MR. FERNSTROM: This is Gary. I think you just said the magic words, can be, because I'm worried about the renewables application where you might well have an electric motor but it's not grid-connected. It's off-grid.

MR. SMITH: Yeah.

MR. FERNSTROM: And we'd want that covered.

MR. SMITH: Right.

MR. SMILEY: Bill Smiley with Trane. Well, what he's talking about is definitely true for standalone fans, but for virtually every fan that shifts out a product in the company that I work for is connected to an electric power input device, usually the grid. Every unit that we ship has a motor and it's connected electrically. It's not driven by a gas engine for a diesel engine or any of that kind of stuff that goes into a building or industrial plant.

MR. BUBLITZ: Mark Bublitz, there's 57 items on the list and I would like to recommend we keep our scope discussion on in the scope area and keep going.

MR. SMITH: Okay, can we go to the next one? Just scroll down to the next one.

Okay, here we have impeller, structure and housing. And the DOE proposal on the ASRAC and has been accepted by our fan committee and is fine with AMCA, so a propeller is a rotary bladed aerodynamic component responsible for the total energy increase to the airstream delivered by the fan.

The structure is any integral component of the fan necessary to support the impeller.

And housing, any integral components of the fan that direct flow into or out of the impeller and/or provide protection to the internal components. The housing may serve as the fan's structure.

It's pretty straight forward. Okay, let's scroll down. And I’m not trying to cut off discussion here, but I think in the interest of time we want to race through these, answer your questions and then have you contemplate and consider.

Okay, here, commercial and industrial, we, our members said we don't know what commercial and industrial is, but we know what non-residential is. The problem with the non-residential name is that there is lots of residential commercial buildings, like hospitals are residential, hotels are residential, multifamily are residential. They often times have larger, central systems. So the use of residential and non-residential is problematic and we don't know what to do about this.

MS. PETRILLO-GROH: Wade?

MR. SMITH: Yes.

MS. PETRILLO-GROH: Laura Petrillo-Groh, AHRI, can you repeat what you were saying about hospitals and multifamily?

MR. SMITH: Well, certainly multifamily is considered residential.

MS. PETRILLO-GROH: For, by whom?

MR. SMITH: ASRAC.

MR. ROY: Three stories or less.

MR. SMITH: Okay.

MR. ROY: Anything above three stories is commercial.

MR. SMITH: Okay. And hotels.

MS. PETRILLO-GROH: Again, three stories.

MS. MAUER: This is Joanna. It seems to me that it would be better to avoid defining commercial and industrial because that gets into application of a manufacturer isn't going to know whether their fan is going to, or where it's going to go.

MR. SMITH: So you'd say don't bother to define commercial and industrial?

MR. SMILEY: Bill Smiley, Trane, that's part of the whole title of what we're working on is commercial/industrial, but I don't know what it is. Well, I have an idea of what I think it is.

MS. MAUER: I think what we're trying to do is define the types of fans as a characteristic of those fans that would be covered, not how a certain fan would be used.

MS. PETRILLO-GROH: Sure, but when we're talking about building a fan into a housing unit, if that's where we're going with this, we certainly do know where our commercial and industrial sectors are versus residential.

MS. MAUER: Well, even a piece of equipment we don't necessarily know, you know, know where it's going to be used necessarily, but I'm not sure that that matters. I think we can just focus on defining it.

MR. CYMBALSKY: Well, getting back to the scope.

MR. SMITH: I'm sorry?

MR. CYMBALSKY: Back to the scope. This is not even part of it. Again, go back to the scope, what's in-what's out?

MR. SMITH: Okay, so --

MR. CYMBALSKY: That doesn't need to be defined.

MR. SMITH: Right.

MR. WHITWELL: So John, I mean I just jumped a little bit ahead on scope. So perhaps we could say the scope, as it relates to HVAC equipment, would be what DOE defines as commercial HVAC equipment, as opposed to residential, right? Where we come off as single phase, less than 65,000 BTU per hour, something like that, right, could be part of the scope?

MR. JASINSKI: Yes, so I think, I'll propose another way to do this. I would say once, to the overall fan definition is important as a mechanism for sort of defining DOE's authority. So that, I mean that's not on the table. But once we start getting into these types of definitions, these definitions will be mechanisms for the test procedure, for defining the scope as the working group wants it, so I think it might almost be better to discuss pretty straightforward about what each of you wants in and what each of you wants out. And then once you have that list, you can come back to these definitions and tweak them to make sure that they align with what the working group agrees to.

For instance, the discussion about grid connected or, you know, do we want helicopter rotary blade, you know, rotors in this. If the working group says no, then you go to these definitions and make sure that they are such that those are not included.

So it's, I would say that doing the definitions first is sort of tempting because I think it skirts maybe the tougher conversations, but it might be better to just be straightforward about what each of you wants in and what each of you wants out, and then the definitions can be crafted to match that.

MR. WAGNER: This is Greg. I'd like to make comments. Hello?

MR. SMITH: Go ahead.

MR. WAGNER: The Department, in recent rulemaking for residential furnace fans, defined what residential was. Why can't it not continue with that same sort of definition that those products outside of that residential scope is what is covered under commercial and industrial, because they do have a rulemaking for residential fans already.

MR. JASINSKI: So what I was saying is that it can, but the way that would impact the rule is, you know, if this working group decided that it wanted certain fans that are used only in residential applications out, it could craft a definition for commercial and industrial or for residential and encompass those, and then vote to exclude them.

So Greg, it could absolutely come up with definitions for residential, commercial and industrial as a mechanism for defining and eliminating the scope for the working group. And then those could be used in the test procedure and in the standard.

MR. SMITH: So, just wait a minute. So Sam, you're saying come back to this later?

MR. JASINSKI: I'm saying make that list of what you want in and what you want out.

MR. SMITH: Okay, I've got it.

MR. JASINSKI: And these definitions are what you use to make that so in the rulemaking.

MR. CYMBALSKY: I think we did exactly this for pumps, as I recall in the negotiations. With the pumps, it's very, very broad and includes some residential stuff.

MR. SMITH: Yep. Okay. Let's go to the next. Scroll down, if you would, a little bit.

Okay, so we haven't figured this out. This is safety fans and certain oddball, difficult process applications, very, very difficult to tackle. There is a philosophical intent that says, you know, safety fans that exist and sit idle but only run on an emergency basis, don't consume much energy and, therefore, don't really matter. And of course are designed for safety and not for efficiency, and that seemed to be fine for everybody, but when you get down to the writing a definition that will be used to exclude those fans but not create a loophole for other fans it becomes very difficult.

And I’m not saying we've given up on it, but I’m just saying that on this subject we sort of ended up where Sam just described -- let's go figure out what we want to have exempt and then we will come back to this question. So we really haven't tackled this one very adequately.

MR. BOTELER: It's a little bit -- Rob Boteler with Nidec, that's a little bit similar with what we do with fire pump motors. And the way we got around that is it's separate equipment class and it is labeled by the NF -- what is it? NFPA?

MR. SMITH: NFPA.

MR. BOTELER: Right, so it has a separate label.

MR. SMITH: Right.

MR. BOTELER: You might consider that.

MR. SMITH: Right. And so that kind of third party approval for certain types of products, et cetera is on the table but we haven't figured it out yet. All right? So, if you all have feedback or ideas about definitions that will help us there, I think that will be most welcome.

Okay, so here's an example, a jet fan. And the fan committee responds that jet fans need to be evaluated based on thrust and power, which is, has nothing to do with the definition. And so we're, we're going to have to come back and revisit this one too. The AMCA members are generally fine with a jet fan being regulated under this regulation unless it is reversible. And if it is reversible, the entire design of the fan has to be compromised so that it can have performance that is specified in reverse flow as well as forward flow. And that compromise includes a lot of efficiency compromise.

So they asked of the fan committee, we asked the fan committee was to create a definition that distinguished these two types of jet fans, and they didn't have time to tackle it basically. So just to make clear for our list of in's and out's, we would be fine if jet fans were in but not fine if they are reversible. The only caveat is that jet fans have a rating standard which has nothing to do with flow and pressure. It has to do with thrust. And the reason that thrust is used is because it's a proxy for the useful output of a jet fan, which is a plume of air moving quickly in a certain direction.

And in a perfect world, you'd actually measure that plume, figure out what the velocity is at some particular distance from the fan. Such a rating standard doesn't yet exist, although it's being talked about, and so the proxy for -- oh, I love that word proxy -- the proxy for that is to measure the thrust of the fan, which is equivalent to its plume power.

MR. WHITWELL: Wait, wait, what are the jet fans, what are these for?

MR. SMITH: To ventilate tunnels and car parts.

MR. WHITWELL: Okay, so it could be, and maybe it's a different probably class for the reversible one versus the ones that are non-reversible.

MR. SMITH: Right. We just have to define it. That was the mission here.

MR. FERNSTROM: Wait, wait, this is Gary, no proxies about it.

MR. SMITH: Thank you.

MR. SMILEY: This is Bill Smiley, without defining specifically the thrust values, a condenser fan could be a thruster or a jet fan because you want to get the air up and away. So just to be certain.

MR. SMITH: Thank you.

MR. SMILEY: So there should be, you know.

MR. SMITH: Lots of things could be. It's what it is.

MR. SMILEY: Yes.

MR. SMITH: So what it is that jet fans are rated on the basis of thrusters.

MR. WHITWELL: Yeah, but I mean a lot of the products are rated differently than what we're talking about here.

MR. BUBLITZ: So do you have a proposal?

MR. WHITWELL: It could be rated on efficiency. I mean I don't know enough about what these jet fans are, but I don't think it should be exempted just because it has a thruster.

MR. BUBLITZ: We're not --

MR. SMITH: We didn't ask for a definite -- we didn't ask for an exemption. We asked for a, we asked for a definition.

MR. WHITWELL: Okay, well I thought the way you were leading up to that, perhaps, in some future point.

MR. SMITH: No, what I said --

MR. WHITWELL: I apologize if I misunderstood.

MR. SMITH: Well, what I said just to be clear is that AMCA group is fine with jet fans being regulated under this regulation using the metrics that we talked about, even though they are different than thrust, and is not fine with a reversible jet fan because it has an efficiency compromise.

And so in the next breath somebody might argue that if we made one for an efficiency compromise -- yeah, I mean all of these things are possible. At the end of the day it becomes a question of how much energy, what's the connected load, what's the effort for the regulators and for the regulated to comply, and is the juice worth the squeeze.

And as the presentation from AHRI and others pointed out yesterday, this is a very, very complicated scope. There's lots of variety here. And in some places you have to start paring it back to become practical. And since the connected load of jet fans is really small, it's a candidate to come off the list, okay?

MR. DIKEMAN: We've still got to define it?

MR. SMITH: Yeah, but we haven't defined it yet. Okay, so let's move on.

MR. HAUER: Wait.

MR. SMITH: Yes?

MR. HAUER: It's Armin Hauer speaking.

MR. SMITH: Yes, sir.

MR. HAUER: I wish everyone could see the European-like relation on that one, talking about the jet fan and exclusive atmosphere and corrosive media. So maybe it would be easy to harmonize them.

MR. BUBLITZ: Do you have that regulation number in your head?

MR. SMITH: Actually, Armin, I think when we first started talking about safety fan exemptions we started with that. And there are some difficulties with the European definitions under the American law. They are permissive in terms of their description of a product linked to its application, and we are trying to find definitions that are not dependent upon how the fan is applied but rather are very clear so that if you're standing, if you're on the beach and -- you know.

MS. ARMSTRONG: That's me.

MR. SMITH: Welcome, Ashley.

MS. ARMSTRONG: Good morning. Cross flow fans -- go ahead?

MR. ROY: I had a question. So you mentioned with jet fans there are a couple of applications, tunnels and parking garages. And so what was it determining, how did you make the determination that the lower the smog level because intuitively it seems like, you know, it would be used in a variety of applications across the board. That there are quite a few tunnels and parking garages.

MR. SMITH: Right.

MR. ROY: So how did you make that determination?

MR. SMITH: We counted the number of jet tunnel fans that our members ship, including their connected load, the horsepower of those fans, and added them up. You know, I might add that jet fans are much more common overseas than they are in the United States. Generally, we don't use jet fans in car parts. They are used commonly, commonly used in tunnels.

MR. ROY: So you have an approximate estimate or is that just proprietary?

MR. SMITH: No to both of those questions. Not proprietary and I don't have an estimate at my fingertips.

MR. ROY: Okay.

MR. SMITH: Okay. Okay, then we come to cross flow fans. What happened to our cross flow fan there? There we go. It's down, another one. There you go.

Is there anything about cross flow fans? Did I miss something? Oh, it was jet fan, okay.

Cross flow fans, another example of a product that has a very low connected load and a very specialty application. We find them in small, through the wall and many split products. Certainly less than one horsepower. In horsepowers that are one or greater, they sometimes appear in air curtains and they sometimes appear in industrial applications where -- well, like in wind tunnels, for example, where they're trying to test and they need the certain air distribution that a cross flow fan gives them and it turns out to be a good solution. But it's an odd ball product and a very small connected load. Each one of these products takes a lot of work to get to a regulation, and this is one - and air curtains - where we want to ask for an exemption.

I think where we are, and we'll let you read this later, but I think where we are over here on the left was just fine with the fan committee. We sort of, in this column here of definitions, so a cross flow fan is a fan in which the airflow path through the impeller blades is in a direction that right angles to the axis of rotation, with airflow both entering and leaving the impeller at the periphery.

And then the definition for air curtains is something that Dave Johnson has been working on with his team. And I'll just let you talk this through, if you would, Dave.

MR. JOHNSON: Yes, Dave Johnson, Berner International. The air curtain fans is a fixed location or air moving device that produces a directionally controlled air stream moving across the entire height and width of a building opening, which reduces the infiltration or transfer of air from one side of the opening to the other, and/or inhibits flying insects, dust or debris from passing through.

There was a request to as it's in a cabinet to somehow from the DOE to add some sort of identifier to it. And we were able to pretty much guarantee that the discharge of a unit always has a width across the building opening that's at least five times the diffuser's depth. So, in any cases where the nozzle is a couple of inches, you know, we're always at least, you know, 36 to 48, towards, you know, all the way up to 16 feet. So this is not your typical fan application, but defined based on resisting infiltration or exfiltration across an opening and, in many instances will, as Wade said in his other applications, make a fan less-efficient to make a product more efficient. We can more effectively resist resistance across an opening by sometimes changing, either making our own scrolls or mismatching housings and impellers to give us a plenum design that will give us a more effective profile of an airstream to cover an opening.

MR. SMITH: So on this particular product the AMCA members are asking for an exemption. And the argument, and it should go on our to-be-determined list, but the argument for an exemption is that the purpose of this product is to save energy, to prevent infiltration across an open doorway. And, you know, its net energy use is negative. Its net energy use is negative. And so, you know, anything that would encourage its use in the marketplace --

MR. SMILEY: What about an economizer? It's the same thing. Net energy --

MR. SMITH: Okay, can we just talk about air curtains for a minute?

MR. SMILEY: Well, you can't --

MR. SMITH: Yes, yes, we can actually. Okay, we're going to talk about air curtains. We can talk about economizers later.

So, the air curtain prevents infiltration and, you know, when you sit down to design an air curtain, as Dave said, you know, you care most about its effectiveness at doing that. And so the best metric, and by the way, the manufacturers of air curtains that are part of AMCA are not opposed to regulation of the efficiency of their product. They would, however, like that regulation to have in its numerator the effectiveness of the air curtain at preventing Infiltration. And in its denominator, the power that it consumes.

So this is one that if you use the traditional fan power as the numerator, you end up with unintended consequences in the design of the product that compromises its performance and could result in a net energy increase.

Laura?

MS. PETRILLO-GROH: I'm still curious to what kind of fans are used in these products. It doesn't seem that the definition is specific to --

MR. SMITH: There are three different types of fans that are used: cross flow fans, forward curved fans, backward inclined fans.

MS. PETRILLO-GROH: So, just --

MR. SMITH: And occasionally, occasionally an axial.

MR. JOHNSON: Dave Johnson, Berner, and also axial fans. All different fan types. And in some instances they're matched and other times they're just embellished. Again, we will take centrifugal impellers but not centrifugal housing to create part of a cabinet to be the housing.

MS. PETRILLO-GROH: So this is quite fairly a similar issue that we're all facing with some --

MR. SMITH: Yes, the difference is they have a really low connected load. In other words, the total, the total --

MS. PETRILLO-GROH: Oh, that's the difference?

MR. SMITH: Yes, that's the difference. I mean, I mean it's a trivial segment of the market.

MS. PETRILLO-GROH: So how would one tell a fan coming off the line is going to air curtain versus one that's going somewhere else?

MR. SMITH: We're not suggesting that the fan that goes in an air curtain should be unregulated. We're suggesting that the air curtain should be unregulated.

MR. WHITWELL: So you're talking about a product class perhaps?

MR. SMITH: Definition.

MR. WHITWELL: Okay.

MS. ARMSTRONG: Wait a minute. Can you explain what you just said real quick?

MR. SMITH: Me?

MS. ARMSTRONG: Yes.

MR. SMITH: Yeah, if the fan, if Berner International purchases a fan, which is one horsepower or above that is regulated, he's buying a regulated fan.

MS. ARMSTRONG: For inclusion into air curtain products?

MR. SMITH: That's correct.

MS. ARMSTRONG: And if he doesn't purchase one and he makes it, let's say he makes it himself in an air curtain product, is that fan still regulated?

MR. SMITH: Well, that's up to the working group and the DOE.

MS. ARMSTRONG: So where is there --

MR. SMITH: The working group to recommend to the DOE --

MS. ARMSTRONG: What is it supposed to be though?

The fan or the air curtain as a whole?

MR. JOHNSON: The air curtain as a whole.

MS. ARMSTRONG: Inclusive of the fan or not?

MR. JOHNSON: I would say it would be inclusive -- Dave Johnson, Berner, I would say it would be inclusive of the fan.

MR. SMITH: Yeah, the answer to your question --

MR. JOHNSON: Whether it would be built into the cabinet and not built as fan to be shipped or sold separately.

MR. SMITH: The fan is regulated, the air curtain, we would propose, is not.

MS. ARMSTRONG: That's not what you just said.

MR. SMITH: Is that, do you agree with that? What I just said?

MR. JOHNSON: Well, the question asked if we, if the air curtain manufacturer was to build a fan, then we would have to regulate the fan to then stick in the air curtain product.

MR. SMITH: Oh, well, I think another scenario which would be more likely is that they buy an unregulated fan and put it in their product, buy it overseas. I know what your concern is.

MS. ARMSTRONG: That's not possible. You just said if they buy a fan, it would be a regulated fan.

MR. SMITH: No, I didn't. I said if it's in the scope of the regulation, and it's a fan and it's made then it's regulated. That would be the proposal.

MR. DYGERT: I have a question with the definition, Ryan Dygert, Carrier. What happens if you have a cabinet that has a, does dual-duty? So it not only moves air through the cabinet but also serves to form an air curtain? I'm thinking of refrigerated display cabinets and such?

MR. SMITH: That's a good question.

MR. BUBLITZ: I should probably write that down.

MR. SMITH: Yeah, I don't know.

MR. WHITWELL: Mr. Smith?

MR. SMITH: Yes?

MR. WHITWELL: In the interest of time, 30 definitions to go.

MR. SMITH: Okay.

MR. WHITWELL: Can we restrict the discussion on scope and keep the commentary on definitions?

MR. SMITH: Okay, so let's move on.

MS. ARMSTRONG: So one thing. We had a client from the webinar, and it's from Rod Coffey (phonetic sp.), and he contends that this is an application not a specific fan-state definition. And that's what my, I mean just following on to that, that's what my question was getting at.

MR. SMITH: Yeah.

MS. ARMSTRONG: What exactly is your ask?

MR. SMITH: Right. Right. Well, the ask is to have the air curtain be unregulated.

MR. WHITWELL: Can we stick to the definitions, please?

MR. SMITH: Well, I was just answering the question. As a comment, Ashley, we have this issue with other products as well where like roof ventilator. You can look at a roof ventilator and say, well, that's a housing wrapped around an unshrouded impeller, but the membership of AMCA, and we would hope the working group supports the idea that a powered roof ventilator is a product, is a fan, and it is regulated under this scope.

That's our intent. That's our proposal. And even though what could be done is break it apart, that's not what we propose that the regulation allow for.

And so, in air curtains, what could be done is you could break it apart. But you run into this, Ashley, on product, after product, after product. And so at the end of the day, you have to make a decision of am I going to regulate it as a product or am I going to regulate it as a minimally testable component.

MS. ARMSTRONG: So we'll let you, just so we all stay calm for 9:00, we'll let you proceed with the definitions. But why intent is important is because if you don't get it right in the definitions, your definitions is how we implement intent.

MR. BUBLITZ: Mr. Jasinski recommended we go through the definitions.

MS. ARMSTRONG: No, I understand.

MR. BUBLITZ: Minus scope and then come back and do the definitions again that more align with the intent of the scope.

MS. ARMSTRONG: Right.

MR. JASINSKI: Wait, maybe to clarify, my recommendation was to not go through the definition.

MR. BUBLITZ: That's what I thought.

MR. JASINSKI: My recommendation was to be upfront about what you want in, what you want out, and then once that list is agreed upon, the definitions can be written to make that so. That was my --

MR. SMITH: Okay, well we'll cross cross-flow fans out.

MR. JASINSKI: And that's fine. And I think then that's the discussion the group should have because what ends up happening is that when you talk about each line and the definition is that you get all these lines of questioning about well, what's the implication? Does that mean it's in? Does that mean it's out? Are we regulating at this point or at that point? And so it's more, I think it's probably more efficient to just have the conversation about is it in, regulated here, not here, et cetera.

MS. ARMSTRONG: Right.

MR. JASINSKI: Just be upfront about what, what you're, what you're asking and what you want and let the group discuss it in that way.

MR. WOLF: So this is Mike Wolf, Greenheck. And so that's what I thought we were asking. And my question is how do we get there because we need some sort of a template to follow, and the template that comes into my mind is I think one of the slides that we had up at the last ASRAC where we got, and let's just start with the helicopter blade, in or out, probably out. Okay, let's talk a backward inclined blower, probably in. Air curtains, maybe. We need to define it more. But go down through those broad categories first and get those on the list, and then what you're saying is come back around and put some definitions.

MR. JASINSKI: Right, I mean --

MR. WOLF: Put them on those products that fall under those.

MR. JASINSKI: Right.

MR. WOLF: Or don't.

MR. JASINSKI: Right. And I can imagine there being three lists. You might have the ones that everybody agrees on, and I don't think anybody knows what those are. It sounds like there are a few out there that everybody could agree on, but we don't know that yet.

MR. WOLF: Right.

MR. JASINSKI: Maybe that's --

MR. WOLF: Maybe that's --

MR. JASINSKI: That's one list. There's another list that everybody can agree on of what's in, and then there's all the stuff in between.

MR. SMITH: Well, why don't we -- I think it's a great suggestion.

MR. WOLF: How do we get to make this?

MR. JASINSKI: Make the three lists.

MR. SMITH: Can I make a suggestion? Yeah, we'll go through the definitions and we'll see the definition and then we can say whether we want it in or out. And the reason I say that's handy is because all the fan, all the fan categories, to be a category we've got to have a definition. So this is useful.

MR. JASINSKI: Yeah, I would agree with Wade. I would say that instead of, you know, air curtain, here's how we, here's the, here's what we're talking about. This is the definition. We're not talking about rewriting this definition. We're saying that once you understand this --

MS. ARMSTRONG: In or out.

MR. JASINSKI: -- what it is and what we're talking about, in or out. Great, so each of these lines, the question, the end question should be in or out, not what should this definition say.

MR. WOLF: Mike Wolf, again, in the interest of I'm just sensing a little anxiety there, but in the discussion -- so the discussion, the question right now on the table with air curtains, in, out or we don't know?

MR. WHITWELL: I think we don't know.

MR. WOLF: Okay.

MR. WHITWELL: From the discussion.

MR. WOLF: Let's go on. Next one. Move on.

MS. ARMSTRONG: I feel that --

MR. WOLF: Do you agree with that, Mark?

MR. BUBLITZ: I think it's a larger discussion, right.

MR. WOLF: But for right now, in, out or we don't know.

MR. STARR: I think part of this, too, this is Louis with NEEA, part of this is just so other people understand what the air curtain --

MR. WOLF: And that's fair.

MR. STARR: Some of these people don't know what an air curtain is until they got to this meeting. So this definition catches that but it would be a bad legal definition. So --

MR. SMITH: Okay, I just want to add that air curtains have a connected load that we estimate at about 50,000 horsepower per year.

MR. WOLF: So just an idea.

MR. SMITH: Say it out loud for the record.

MR. JOHNSON: Dave Johnson, Berner International, that 50,000 includes below one horsepower.

MR. SMITH: Okay, axial fan, so we ended up with this definition here. A fan in which airflow enters and exits the impeller parallel to the shaft access. The axial fan may or may not be equipped with a cylindrical housing, inlet or outlet guide vanes, outlet diffuser, orifice panel or orifice ring.

Any questions about that?

MR. WAGNER: This is Greg.

MR. SMITH: Go ahead Greg.

MR. WAGNER: Within, since these are legal definitions, does something like parallel mean it has to be exactly parallel? In previous line, in the cross flow it was essentially perpendicular and then it was changed to just perpendicular. So if it's off at 91 degrees, does that not qualify?

MR. JASINSKI: This is Sam Jasinski. Is there a specific fan that you have in mind that is at 91 and would not meet this definition that you think it should? Or, because again, that question sounds like we're trying to tweak the definition and I think that it would be better to say if everybody in the room pretty much agrees on what an axial fan is, regardless of legal definition - a legal definition, like I said, can come later - but if everyone in the room is thinking of the same set of fan when we say axial fans, I don't think we need to necessarily have that discussion. We just need to say if this, are axial fans as we all understand them to be, in or out, or we don't know. And then the legal definition can come later.

But if there is a specific fan that you don't know how to classify as either axial or I guess the other one would be mixed flow because of the angle of the air, then maybe this would work well in the discussion.

MR. WAGNER: It does get tricky when you start getting into mixed flow versus axial, even some centrifugal versus mixed flow. But back to the cross flow, they don't really exit perpendicular. It is essentially perpendicular. They often, you know, they'll go in different directions.

But anyhow, my point is that if these are legal definitions, which somebody said a little bit earlier, we should be a little more precise in what we're trying to say.

MS. ARMSTRONG: And I think what you're hearing from DOE is we will be more precise at some point in time, perhaps not today and, in all honesty, once our lawyer team gets a hold of these definitions you're going to see words replaced. So it would be a good exercise to give us some chance. Once we understand the overall intent and what you guys want, give us a chance to work with them a little bit in terms of what they'll look like in our framework and bring them back to you guys.

MR. WAGNER: Well, okay, this is where I agree with what Armin had said about the ISO definition, and they do have some angular measurements and requirements on what you have to meet, and that was a nice way to put clear-cut definition of what you mean by axial, centrifugal and mixed flow.

MS. ARMSTRONG: Sounds good. Thanks.

MR. SMITH: So I would say we assign the fan committee to go back and take a look at that.

MR. PERSFUL: Axial fan --

MR. SMITH: Is that specific assignment?

MR. BUBLITZ: Yeah.

MR. SMITH: What is the specific assignment?

MR. BUBLITZ: To test the word --

MR. SMITH: To test the word --

MR. BUBLITZ: Oh, on axial, got it.

MR. SMITH: And the next one is vane axial, which is an axial fan with a cylindrical housing with guide vanes before or after the impeller, or both.

MR. SMILEY: So I think, do the, the axial fans are in, right?

MR. SMITH: Some axial fans are in, certainly, but possibly not all.

MR. SMILEY: So this is Bill Smiley with Trane. So vane axial, tube axial and panel fan are all three subclasses of an axial fan?

MR. SMITH: Fair enough.

MR. SMILEY: Because axial fan includes those.

MR. SMITH: That’s true, also jet fans.

MR. SMILEY: Yes, well, yeah.

MR. SMITH: The next one is tube axial, an axial fan with cylindrical housing and no guide vanes. Okay.

The next one, the panel fan, an axial fan without a cylindrical housing, which is mounted in an orifice, ring or panel.

Any concerns or comments, or questions?

MR. PERSFUL: This is Trinity. Do we need to say in or out, or are we just silence is consent?

MS. ARMSTRONG: In.

MR. SMITH: We can test this. These three, and the AMCA group would suggest that they are, they would be regulated. Is anybody, does anybody want to argue for an exclusion?

MR. SMILEY: Bill Smiley, Trane, I think in general, yes, they would all be in, but there may be some limits that we define later in scope.

MR. SMITH: Sure.

Okay, the next one is circulating fan, a non-ducted fan which has no provision for connection to ducting, or separation of impeller from its outlet -- excuse me, separation of the impeller inlet from its outlet, used for the general circulation of air within a confined space.

And the proposed revision, let's see, the fan committee suggested deleting the last sentence. Okay. So the proposed revision was a non-ducted fan, which has no provision for connection to ducting or separation of the propeller inlet from the outlet designed to be used for the general circulation of air.

And then the advocates added here that a circulating fan has no housing or other than the safety guard, and then fan committee challenged the additional sentence as adding no value.

So do you guys, and I must say that the advocates have not seen these comments. So if you want to talk about it you can, and if you want to wait and talk about it later, that's fine too.

MR. MATHSON: Wade, this is Tim Mathson. I would say that the fan committee said that there are circulating fans that have small housings. So that's why they suggested that.

MR. SMITH: Really? How do you distinguish them between a circulating fan and a panel fan?

MR. SMILEY: This is Bill Smiley, Trane. Wouldn't it be the separation of the inlet and the outlet would be the defining difference between the circulating fan and the panel fan? Because you could have like a box fan instead.

MR. SMITH: Yeah, that's a perfect example. It has the small housing but it's a circulating fan.

MR. SMILEY: Yeah, but a circulating would be one without separation, or no separation.

MR. SMITH: No separation.

MR. STEVENS: This is Mark. I don't agree with that because there are circulating fans that do have housings to direct the airflow. The difference between that is that this is generally like a rolled housing. It goes around. It you look at a panel fan, it's just normally square with some sort of orifice.

MR. SMITH: Right.

MR. STEVENS: So a panel fan actually has a panel attached to it.

MR. SMITH: Right, so, but what you described in the first case was a tube axial fan, is it not?

MR. STEVENS: A tube axial, it looks like a tube axial fan. Yeah.

MR. SMITH: So how do I distinguish it from a tube axial fan in definition?

MR. SMILEY: Bill Smiley, Trane, I would say generally the inlet and outlet.

MR. STEVENS: Generally, the shape of the blades. I would say they are normally flatter, wider with tube axial.

MR. MATHSON: You know, Tim Mathson from Greenheck again, many of these fan designs have just been applied in both cases, in both applications. You know, panel fans can be hanging up in a back room.

MR. SMITH: Right.

MR. SMILEY: Then it's a circulating fan.

MR. MATHSON: It's a circulating fan.

MR. SMILEY: Because there's no -- Bill Smiley, Trane, because there's no separation, adequate separation.

MR. SMITH: So I think the intent though, is it not, that -- this is Wade, that if the fan is intended, it's manufactured so that there can be a separation, that's what's anticipated, the fact that it's applied as a circulating fan, it doesn't matter, it's a panel fan and it may be applied as a circulating fan but it's a panel fan?

MR. SMILEY: Bill Smiley, Trane, then it ends up like your air curtain discussion. It's the application.

MR. SMITH: No, it doesn't end up like the air current discussion.

MR. STEVENS: Well, let's get back to your question on tube axial versus circulating.

MR. SMITH: Right.

MR. STEVENS: The tube axial generally will come with some sort of appliance, as you said, to hold up the ductwork. In a circulating fan, the housing will not.

MR. DIKEMAN: Right.

MR. SMITH: So if we go back to the tube axial fan, cylindrical housing with guide vanes before and after the impeller guides, so no cylindrical housing and guide vanes. So you're saying that the existence of a cylindrical housing is not sufficient to call it a tube axial fan? It also has to have duct connections?

MR. STEVENS: On at least one side.

MR. MATHSON: Yeah, this is Tim Mathson. I was going to suggest that same thing. One of the unique features of a panel fan and a circulating fan is no provision for connection to a duct. That's one obvious feature that we hadn't talked about.

MR. SMILEY: So, Bill Smiley with Trane, so you can only connect it to a duct if it has a fan? I mean, you know, now we're starting to, you don't need a fan to hold a duct up. It's typical that that's convenient. I mean this is just going to be like the discussion with the air curtain. The fan and air curtain --

MR. JOHNSON: This is Dave Johnson, Berner International, with the air curtain discussion, what I failed to mention is that, you know, the rating methods are different. Air curtain, in what we're discussing here is how to efficiently move air. And with an air curtain, the intent is not to officially say connect the load and move air.

MR. SMILEY: I say air curtains are out.

MR. JOHNSON: You know, what we're, what they would be measured upon is how well they effectively save or prevent infiltration from across an opening. And that's why, whether they build the fan or whether we purchase a fan, it really should be rated on the product effectiveness and not necessarily it -- because it will fail if you take how much energy we move air. But we don't really care about how much air we move, we care about how well we cover that opening.

MR. FERNSTROM: So this is Gary. I take exception to that premise. You know, I agree that the air curtain's primary purpose may be to improve the efficiency of heating and cooling systems by reducing heat loss through doors, but there is no reason why an air curtain can't move the same amount of air in the same manner to accomplish that purpose and use a more efficient loader, and use electricity in the process of achieving that outcome.

So to say we don't need to worry about them because they're saving heating and cooling in energy isn't really addressing the energy efficiency opportunity.

MR. JOHNSON: This is Dave Johnson, Berner, what I’m saying is we don't have to, we can't rate them. I'm staying, or I'm saying that we should not rate them based on energy consumption and air output. You would rate them on effectiveness and energy input. If I have, if I have two products that have the same rating that are capable of preventing infiltration, the product that consumes the less energy would be the more efficient product. You would not rate that based on -- the product that does a better job may move less air, you know, but based on a fan rating that would be less efficient because you're putting in the same amount of energy but getting less air out of it. I can put the same amount of energy into a product but get a more efficient air curtain.

MR. FERNSTROM: How then would we get at the opportunity associated with driving the fan with a more efficient motor?

MR. JOHNSON: Effectiveness, which would be a different type of rating that doesn't exist right now.

MR. DIKEMAN: You guys are on parallel train tracks right now.

MR. SMITH: Right. You both are in the same direction. This is Wade. The air curtain folks are not regulated. They are against a regulatory metric that has the unintended consequence of increasing energy use.

MR. FERNSTROM: Okay, this is Gary. So I understand and concede.

MR. TEAKELL: Let the record show.

MR. SMITH: Just say thank you and move on. And move on we shall.

Okay, here is centrifugal fan.

MR. WAGNER: This is Greg. This is Greg. I have a question on that wonderful housing. There's going to need to be a definition on housing if there's some question about how you distinguish between a panel fan and a tube axial.

MR. SMITH: Yeah, I think we should take that into the notes and revisit the question because I agree with you. This cylindrical housing thing is a bit of a can of worms. So we need to tackle it again.

MR. MATHSON: Tim Mathson again, and you know, hopefully, what we have proposed is an efficiency metric that doesn't depend on these definitions. It depends on how the fan is tested. So hopefully this is all minor details that don't even matter that encourages substitution between a panel fan and a circulating fan.

MR. SMITH: Well, it does matter because the definitions also need to distinguish between the circulating fan and a tube axial fan, right?

MR. MATHSON: I don't, I don't, I don't necessarily think that.

MR. SMITH: Well.

MR. MATHSON: I think it distinguishes, what may distinguish those is whether the fan was tested with an outlet duct or not.

MR. SMITH: Well, so we're also asking for an exception for circulating fans because the connected load above one horsepower is nearly zero. And that's why the definition matters, okay?

MR. MATHSON: Yes.

MR. SMITH: So in one case you test it and in the other case you don't bother.

So that should be on the -- maybe circulating fans should be on the I don't know list. Okay? In other words it's been proposed that circulating fans will be exempt.

Okay, centrifugal fans, a fan in which airflow enters the impeller parallel to the shaft axis but changes direction within the impeller and exits the impeller perpendicular to the shaft in a radial direction. The impeller may have one or two inlets and may or may not have a housing component.

Could you just scroll down and see what the fan committee said about this?

The fan committee said prefer to stick with our definition in column D. And at the end of the sentence, after the word rotation, the first time, add a new sentence, the tangent to the blade of the tip must be at least 25 degrees from it.

Let me explain why it turned out that way. So --

MR. WHITWELL: But wait a minute. You skipped down. You went down one. Right, we were on centrifugal.

MR. SMITH: Oh, no action required. Thank you very much. Thank you very much. Any questions about the centrifugal fan?

MR. BOTELER: You're too close to it.

MR. SMITH: The mind says, come on Wade, hurry up. Okay, go to the next one.

So here we have --

MR. WAGNER: Well, before you get off that.

MR. SMITH: Yep.

MR. WAGNER: Greg again. Before you get off of that, I'm not sure what exactly is meant by those, by those words of outward direction and opposite. I think a little more clarity in what you're saying, and I wrote you a note on this a few days back, last Friday, specific, and that is maybe it's better to define it as 25 degrees tangent to the blade tip and define where you're saying that. In the European Union it's mid-blade, but it could be the most outermost portion of the blade because there are blades that have skew to them. There are blades that are not straight. There are a lot of different things there that could have a variety of implications on that backward curve.

MR. SMITH: Well, we didn't talk about backward curve yet. We talked about centrifugal fan.

MR. WAGNER: Oh, I'm sorry. My screen scrolled down.

MR. SMITH: Well, yeah, our screen scrolled down too. Are you okay with the definition of centrifugal fan or does your comment apply there?

MR. WAGNER: I think I am. Again, back to that angular exit or perpendicular shaft. Is that exactly perpendicular? The European Union puts a range on it. I think that might be more appropriate.

MR. SMITH: Okay. So then we go to the next one, which is backward bladed, house centrifugal backward bladed. Where we ended up here, let's see, we started on the left column. This is the one where the fan committee is recommending column D, and there was proposed revisions from the advocates.

So let me just read what the fan committee is proposing. A type of centrifugal fan with a housing and with impeller blades that are sloping backwards relative to the direction of rotation by more than 25 degrees from the perpendicular to the axis of, from a line that is perpendicular to the axis of rotation. This 25 degree number becomes important to distinguish between a backward incline, a radial and a forward curve fan.

And the advocates said opposite the direction of rotation. And I think the fan committee said they didn't know what that was. So they suggested, instead, that we just use the tangent of the blade at the tip must be at least 25 degrees from radial.

MS. ARMSTRONG: So can I just ask a higher level question?

MR. SMITH: Uh-huh.

MS. ARMSTRONG: Why do you think you need those definitions?

MR. SMITH: Um.

MS. ARMSTRONG: Like backward, forward, I mean at the end of the day they all fall down to the highest level, you know, house centrifugal. That's it.

MR. SMITH: True enough, but Ashley, there are classes of fans that are subordinate to the general category of ducted fans, which appear in the NODA, and which invite discussion about performance standards that are different by different categories. And so we feel that it's important to define the different categories. If we choose then to lump them together in the regulation, that's a decision that can be made later, but we've gone to the hard work here of defining these because they appeared in the framework, and the notes, both of them, and so that's what we're doing.

MR. WAGNER: And there's functional utility to them.

MR. SMITH: Right.

MR. WAGNER: There's radial fans that definitely need to be in place, but how do you define the radial from any other centrifugal.

MR. SMITH: And I think to Sam's point, if we come back later and we say this definition isn't important, then we can dispense with it.

MR. SMILEY: Bill Smiley, Trane, those do provide a very distinguishable, recognizable, accurate review about a fan as to what type it is.

MS. ARMSTRONG: Well, you --

MR. SMILEY: You said yesterday you want to be without argument.

MS. ARMSTRONG: Well, I do, and for the purposes, you know, if we are, so it depends on how we end up here. I mean if we ultimately treat them as different equipment classes because they meet the equipment class criteria, then yes, you would need to be able to distinguish different equipment. If we ultimately decide on a high level this category of fans should not be subject to the potential regulations of this committee, then that's also important to have a clear distinction.

However, if we're defining five different categories of fans that get lumped into one equipment class for the purposes of regulation because individually those five utilities don't have, or five different categories don't have the attributes necessary to meet our equipment class criteria under the statute, those definitions don't matter.

MR. SMITH: They do have sufficient difference to meet the criteria of a separate class.

MS. MAUER: This is Joanna. But we had talked about two classes originally, right?

MR. SMITH: Well, we talked about, actually, originally, originally we had many. But we boiled them down to two, yes.

MS. MAUER: So then they still --

MR. SMITH: I understand. It's a definition of a backward inclined fan. You asked us to define it. We did.

MR. STARR: I think it helps frame the discussion, too, is the other part so that everybody is talking about the same thing.

MS. ARMSTRONG: I think what I'm telling you here is that it's great for the discussion purpose --

MR. STARR: Right.

MS. ARMSTRONG: -- it's great to have a discussion about what's in and what's out, that's what matters, but what you may see in a regulation, or what we may come up with down the road may not look like this because things get collapsed for different purposes, statutory requirements are slightly different. So I think it's okay, it's fine for the purposes of discussion, but I want you to understand that ultimately collapsing into two equipment classes or a couple of equipment classes, a handful, whatever they end up being, then subcategories of definitions become unnecessary.

MR. WAGNER: This is Greg again. We could take that up another level and say why do we have a different definition of centrifugal, or mechanical or some kind of energy to turn that shaft to convert it to energy. There is utility in differences between backward centrifugal, radial centrifugal and forward centrifugal, and to ignore that would be not in the interest of this group I don't think.

MR. SMITH: Okay, if we could go down to the next one. We're at forward curved. And so the suggestion was to use this definition here. A type of centrifugal fan with a housing and impeller blades that are curved forward, relative to the direction of rotation, such that the direction of the blades at the impeller periphery are more than 25 degrees from perpendicular to the axis of rotation.

And the suggestion is to use, to delete the word bladed from column A, with house centrifugal forward bladed doesn't -- I realize it's a forward curved blade, but all fans have blades. So bladed doesn't add a lot of value. And to use the wording in column D, which is what I just read, the advocates suggested something called position forward relative to the direction of rotation. And it isn't the positioning of the blade, it's actually the angle of the blade at the discharge.

MR. WAGNER: This is Greg again. I think that, I think that position forward relative to the direction of rotation is kind of unclear in my mind what you mean by that. You probably should use the same kind of definition you have up in the backward curve, just from the standpoint of defining what you mean by 25 degrees.

MR. SMITH: Greg, would you be willing to draft a proposed change?

MR. WAGNER: Yeah, I sent you one and I'll resend it. I'll clean it up a little bit.

MR. SMITH: Yeah, why not send it, send it, send it to the group so it's in the public record, okay?

MR. WAGNER: All right. I got you.

MR. SMITH: Okay, the next one is radial bladed.

And here we ended up with a type of centrifugal fan with a housing, with impeller blades positioned such that the outward direction of the blade at the impeller periphery is within 25 degrees of the access rotation.

The next one is unshrouded radial blades. Some of the AMCA members have suggested that an unshrouded radial bladed fan is both an efficiency compromise and has some useful purpose, reason, related to its material handling duties. And they, therefore, propose that an unshrouded radial bladed fan be exempt from regulation. And we have to do the homework to define what the connected load is there. I believe it will be relatively low. And of course we need a definition. The fan committee didn't understand why we were asking for the definition, and that's the answer.

So I think we still need to do some work in this area.

Laura?

MS. PETRILLO-GROH: Laura Petrillo-Groh, what's the difference between unshrouded and then unhoused?

MR. SMITH: Well, a shroud is a piece of the impeller that has no, it's not part of the housing. It doesn't have anything to do with the housing. It has to do with the impeller. So a shroud, if you think about it, if you think about a centrifugal compressor. It has a, you know, a back blade and gas comes in and, you know, and it exits like that and the blade sort of exits like that, right?

MS. PETRILLO-GROH: Yes.

MR. SMITH: Well, so if there's a piece of metal on the inlet side that shrouds the gas and captures it between the back blade and the front blade, that front blade is called a shroud.

MR. WHITWELL: It's rotating with the fan.

MR. SMITH: It's rotating with the wheel, right?

MS. PETRILLO-GROH: Okay.

MR. SMITH: And it's also a common application, especially in compressors is to have the blades but no shroud, so the blades are sort of passing the housing, if you will; the housing is becoming part of what's channeling the gas from the inlet to the outlet.

MS. PETRILLO-GROH: Thank you.

MR. SMITH: So in fans, there's always a shroud except when the application is concerned about material clogging as it goes through the fan. And these fans are being used specifically for material handling. The best example, your vacuum cleaner, its purpose is not to move air. Its purpose is to move dirt. And so it's a dirt handling fan, okay?

MS. PETRILLO-GROH: Thank you.

MR. PERSFUL: This is Trinity with Twin City Fans.

MR. WAGNER: Another one.

MR. PERSFUL: This is Trinity with Twin City Fans. While Wade had mentioned there are some members that want an exemption for this class, there are other members like ourselves that don't want an exception for this class. So I just want to put that.

MR. SMITH: Right. So it's a question mark.

MR. DYGERT: Ryan Dygert, Carrier, I just wonder why we would break out a radial fan that's unshrouded and not a backward curve as unshrouded.

MR. SMITH: We know of no examples of backward inclined fans that don't have a shroud.

MR. DYGERT: Well, there are. You can always put the shroud in the stationary component in the clearance gap at the tip of the blade.

MR. SMITH: We don't know of any such fan.

MR. DYGERT: Okay.

MR. WAGNER: Well, there are, and you mentioned the vacuum cleaner, and having designed a few when I was much younger.

MR. DYGERT: Right, it is done. I can assure you.

MR. SMITH: At one horsepower and above?

MR. DYGERT: At one horsepower and above I can't.

MR. WAGNER: Yes, vacuum cleaners are above one horsepower. All of them are 1,200 or 1,400 watts.

MR. SMITH: Okay. That's a good comment.

Okay, the next one is unshrouded centrifugal, a centrifugal fan without a housing that may be arranged in an array of discharging, in an array and discharging into a plenum.

Let's say, we prefer the definition in column C, a centrifugal fan without a housing. And the advocates have suggested which may be arranged in an array discharging into a common plenum.

So there's some options there that we really haven't settled, but the simple one is the one that AMCA members preferred, a centrifugal fan without a housing.

You don't agree?

MR. DIKEMAN: This is Steve Dikeman. There are examples of housed centrifugal fans that are not connected to a duct. So if you look at the far right column, that was one of the things that we went through at last fan committee.

MR. SMITH: Right. Right, but the conclusion that you came up with is to use the definition in column C.

MR. DIKEMAN: Without a connecting duct.

MR. SMITH: Oh, I'm sorry, so what you're suggesting is a centrifugal fan without a housing --

MR. DIKEMAN: With or without a housing that is not connected to, does not have an outlet duct. There needs to be a breakoff there.

MR. SMITH: So you're suggesting that an unhoused centrifugal could have a house?

MR. DIKEMAN: A housed centrifugal might not have an outlet duct.

MR. HAUER: Housed centrifugal.

MR. SMITH: Okay, this is the definition for an unhoused centrifugal fan, yes?

MR. DIKEMAN: Yes, but the definition of a housed centrifugal is that it has a duct. There can be a housed centrifugal without a duct.

MR. SMITH: This is the definition for unhoused centrifugal. Are you suggesting a change?

MR. DIKEMAN: Well, once we get between housed and unhoused there's a third mutant, housed centrifugal without an outlet duct.

MR. WAGNER: So is that a configuration question?

MR. DIKEMAN: Yes.

MR. WAGNER: You know, as they do in the EU?

MR. SMITH: Well, Steve, you can apply a utility fan, for example, and common, it's common to apply a utility fan with no duct.

MR. DIKEMAN: Um-hmm.

MR. SMITH: But it's tested and rated as a ducted fan.

MR. SMITH: Um-hmm.

MS. ARMSTRONG: So I would argue that ducting should have nothing to do with the definition, because what we're doing here is going to be specifying the ducting as part of the duct realizing that when applied actually implies the majority go into this and there may be some exceptions.

MR. DIKEMAN: It's actually from the testing configuration that this problem occurs. A housed fan that would not have an outlet duct.

MR. SMITH: Which the manufacturer rates based on a test with no duct.

MR. DIKEMAN: I mean that's where the fan array comes into this conversation for that very reason, and that's where we've settled out that without the connecting duct. So, anyway, between unhoused centrifugal and housed centrifugal, we've got a third member up there to just capture at some point.

MS. ARMSTRONG: Thank you.

MR. SMITH: Just a point of clarification, as Wade said, would that essentially, Steve, become a new fan category which would be in the unducted group?

MR. DIKEMAN: Well, I think that's where we have our categories, you know, unducted and ducted, sort of transcends some of these definitions. So one way or another we just have to capture it.

MR. MATHSON: Yeah, this Tim Mathson, regardless of where we put that fan array product, it would be tested without a duct.

MR. SMITH: Um-hmm.

MS. ARMSTRONG: Right.

MR. MATHSON: So it does have a housing around it but it would always be tested without a duct.

MR. DYGERT: Ryan Dygert, Carrier, I would make the same argument for a housed axial fan because there's nowhere it says a housed axial fan can't duct into a plenum.

MR. SMITH: That's a question of how the manufacturer normally rates the product. Rating tables have to be based on something.

MR. DYGERT: I agree but I think this goes back to the, you know, we start talking about using static and total efficiency and we need to pay attention to the outlet into the plenum. You can't just automatically assume that a housed axial fan and a housed centrifugal fan are always ducted.

MR. SMITH: Well, what you can do, however, is observe how the product is offered for sale in the marketplace.

MR. DYGERT: Right.

MR. SMITH: If the product is offered for sale in the marketplace using ratings that are tested in a configuration with a ducted outlet, then it's a ducted-rated --

MR. DYGERT: No, no, no.

MR. SMITH: -- and has efficiency that's based on that rating. If it's tested and rated and cataloged based on no duct, then it's a completely different circumstance.

MR. DYGERT: So if I have an invented fan and I'm rating it on total efficiency and I put it to a product where it comes into a plenum where the only thing that matters is its static efficiency, then I disagree with that point. Even if the product is ducted, the fact that the fan is invented and is not communicating directly with the duct it's recovering the velocity pressure --

MR. SMITH: The question, the question is what is the basis of your rating?

MR. WHITWELL: Yeah, but we're talking about fans, it's separate from the rating of the equipment itself, right?

MR. SMITH: The question is when you represent it to your customer, what are you representing it as? How, what's the test configuration that you identified to your customer? What's the assumption about how the product will be applied that's built into your ratings?

MR. ERNST: This is Skip Ernst. They can apply today without regulation. It's the fan in the whole box. That's what's represented to the customer.

MR. SMITH: And do you base it on the duct leaving the box or --

MR. ERNST: Yes.

MR. SMITH: -- or a plenum discharge leaving the box?

MR. ERNST: Normally with the duct.

MR. DYGERT: Normally. If I take all the kinetic energy out of this fan and dump it into a plenum and squeeze it back down in the duct, the fact that the product was ducted at the inlet and outlet has no never mind how --

MR. SMITH: Well, how do you rate the product?

MR. DYGERT: But what we're talking here is taking the fan as a component out of the system and identifying its efficiency levels.

MR. WHITWELL: Yes, it's two different things.

MR. DYGERT: Yeah.

MS. MAUER: This is Joanna. I think we probably need some more discussions. I think what we had talked about previously was based on what category a fan falls into could be tested either ducted or unducted. And there may be a different way to do it.

MR. WHITWELL: Yes, that was last week's, or last meeting's discussion was a lot of the time was spent on that, testing.

MR. SMITH: So if you end up for embedded fans, if the answer at the end of the day is we're going to take that fan out of the unit and we're going to rate it independently, this becomes a very important question.

MR. WHITWELL: Well, that was the discussion last week. That was the tested combination was the fan, and the housing --

MR. SMITH: If you --

MR. WHITWELL: -- and the motor.

MR. SMITH: Yeah.

MR. WHITWELL: And the structure.

MR. SMITH: If you decide that's what you want. Yesterday there was a presentation up here that advocated a completely different approach. My point is that there is more than one approach and it depends on what approach you choose as to whether or not this matters.

MR. WHITWELL: Sure. I agree.

MR. SMITH: Okay.

MR. WHITWELL: Yeah, but still we should keep in mind that there are ducted housed and unducted housed, right?

MR. SMITH: Makes sense. Mixed flow, okay, we ended up with I think in column D, a fan in which air flow enters the impeller parallel to the shaft access but changes direction with the blade passage to impart partial radial directions of the flow. Airflow in a mixed flow fan must exist in the impeller at greater, at a greater mean diameter than the inlet and must exist the impeller at an angle between full and axial and 25 degrees of radial. The mixed flow fan housing may be similar to either an axial or a centrifugal fan, while the air flows through the impeller is between --

MR. WHITWELL: Centrifugal and axial.

MR. SMITH: -- centrifugal and axial.

And the advocate comment is there a need to define a fan which airflow enters the impeller in a direction between parallel and perpendicular to the axis of rotation. And the response was no, because none of us know of any such fan that exists or probably ever will exist.

Armin?

MR. HAUER: Armin Hauer with ebm-papst. My company makes mixed flow fans without housings. It's basically a plenum fan and then the discharge is at an angle. And it's unducted.

MR. SMITH: So the difference, would this definition apply to that fan?

MR. HAUER: Well, you're speaking about a housing here and the diameter of the inlet and the outlet.

MR. SMILEY: This is Bill Smiley at Trane. You would need to add applied without a housing or with a housing similar to the axial.

MR. SMITH: Well, I don't see any reference to housing in this definition. I guess I'm missing it.

MR. SMILEY: Look at column D.

MR. SMITH: Housing may be similar.

MR. SMILEY: Yeah.

MR. SMITH: So maybe, maybe that needs to be accommodated.

MS. MAUER: And this is Joanna. I would defer to make, but I think the question was more kind of thinking could someone develop some different fan.

MR. SMITH: Right.

MS. MAUER: And not necessarily does this stay.

MR. SMITH: Right. And I understand the question and the only thing I'll tell you is that the fan guys said, phew, no.

MR. WAGNER: This is Greg. On that comment question where it says the fan, I would say it should either be average or essentially parallel or perpendicular because air does enter not perpendicular or parallel to the shaft. There should be some qualifier there.

MR. SMILEY: It depends on what plane of the entry you're at you define the entering air direction. If you define it at the throat of the inlet column --

MR. SMITH: Right.

MR. SMILEY: -- it's pretty much parallel to the axial direction. If you define it a half an inch either way, it's going to be angled. It comes in, the bell-mouth inlet comb pulls air in from all around and directs it in.

MR. SMITH: So you would suggest clarifying the location of the inlet?

MR. SMILEY: I'm okay with it.

MR. WAGNER: Half our entire --

COURT REPOTER: Could you repeat?

MR. WAGNER: The air coming through the inlet of an impeller, whether it's, you know, an unhoused centrifugal or an axial fan, or those that don't have a duct directing air directly into the inlet comes in at angles other than straight along the axis of rotation. So, therefore, it should be essentially, or on average, or something like that in terms of entering in the direction of rotation.

MR. STARR: I think the word he said was half of a sphere, if that was what you were missing.

MR. SMITH: Okay, so Greg, could you include that in your write-up, if you would, when you send it up?

Mr. WAGNER: Sure.

MR. SMITH: Thank you. Okay, next one.

Induced flow fans. You may have to scroll up just a bit. Oh, inline centrifugal, a house fan with a centrifugal impeller designed with the necessary housing and fittings to be mounted between duct sections with air flowing in an axial direction at the inlet and the outlet.

There was a suggestion from the advocates, which the fan committee agreed with, which says design, we recommend deleting the word design. Okay, so a housed fan with a centrifugal impeller with the necessary housing and fittings to be mounted between the duct sections with air flowing in an axial direction at the inlet and the outlet.

And they're suggesting replace the word fittings with structure. The necessary housing and structure to be mounted between duct sections.

So, again, if you've got --

MR. SMILEY: Bill Smiley, Trane, so the intent is that this has to have an inlet and outlet? Or just fitting so you could connect it?

MR. SMITH: Tim?

MR. MATHSON: Tim Mathson, I would say just, it just has fitting for connection. None of these say whether they have to have a fitting for the duct.

MR. SMILEY: Well, then it's not that clear. Okay, I see what you're saying but we need to change a word or so.

MR. DIKEMAN: Steve Dikeman, remember that part of that conference call, fittings seem like it could be perceived as a loophole and structure, it was, we felt it was more universal than fittings.

MR. SMITH: So Bill, if you have a suggestion to change, why don't you write it up and submit it, okay?

MR. SMILEY: Okay.

MR. SMITH: Okay, now we've got induced flow fans. A housed fan with a nozzle and a wind band whose outlet airflow is greater than its inlet airflow due to an induced airflow. All the flow entering the inlet will exit through the nozzle. The flow entering the wind band will include the nozzle flow plus induced airflow -- exiting the wind band, excuse me, will include the nozzle flow plus the induced airflow.

We're asking for an exemption for induced flow fans, I believe. Okay. These are safety fans, laboratory fans and have a relatively low connected load, the size of which is in our database that we submitted to DOE. I don't remember what it is but it's a pretty small number.

Okay. Centrifugal power roof and wall ventilators, a fan consisting of a centrifugal impeller with an integral drive with a housing designed to prevent precipitation from entering the building and with a base designed to fit, usually by means of a curve over a roofed or walled opening.

And the advocates suggested weather resistant housing rather than housing designed to prevent precipitation. Oh, AMCA changed it to weather resistant housing and advocates were okay with that. So this is where we ended up, right here.

Any questions or comments on that?

Okay, next one? Axial, it's the same line just substitutes the word axial for centrifugal. So it's a fan consisting of an axial impeller with an integral drive, with a housing designed to prevent precipitation from entering the building and a base designed to fit, usually by means of a curve over a roof or walled opening.

Okay. Okay, then in the most recent NODA, there were questions about definitions of embedded fans, ducted fans, non-ducted fans, et cetera, and you can collapse, if you would, columns B through E because there aren't any, and then we can better see this, I think.

IT SPECIALIST: You mean hide them?

MR. SMITH: Yeah, hide, yeah, I'm sorry, hide columns B through E.

MR. JOHNSON: Right-click on it.

MR. SMITH: That's okay. That's enough. We got it.

You know, you might go to the top and click on F, and then under the Home, wrap text. There you go. Okay.

So now we've got, we didn't tackle embedded fan and I don't know that we need to, but anyway, we didn't. Okay?

MR. SMILEY: Well, Bill Smiley, Trane, isn't that just as important as tackling the definition for powered roof and ventilated?

MR. SMITH: Yeah, we just didn't do it.

MR. SMILEY: Right, so what's to say it's not important. It may not be important to the panel --

MR. SMITH: I didn't say it wasn't important.

MR. SMILEY: Yeah, you did.

MR. MATHSON: Well, this is Tim Mathson. Thankfully no matter what we say, this group is going to argue about it.

MR. SMILEY: Oh, yeah.

MR. MATHSON: We just avoided it. We didn't say what was important.

MR. SMITH: If I said it wasn't important, I misspoke. I'm sorry.

MR. SMILEY: Or I misheard. My ears are old.

MR. MATHSON: It's probably the most important thing here but we didn't want --

MR. SMITH: We didn't tackle it.

MS. ARMSTRONG: And I don't think we need to worry about the definition right now until we actually figure out our intent with scope. So I would just keep on going.

MR. WHITWELL: Yeah, I mean I assume --

MS. ARMSTRONG: There's no reason to deal with it.

MR. WHITWELL: Assuming that most fans, if not all, are embedded somewhere in something.

MS. ARMSTRONG: Yeah, and I'm not sure that DOE would agree that a definition of an embedded fan is the right way to execute anything. We might agree to not setting standards for it at this point in time.

MR. SMITH: So this is the first time, you know, we've seen these, but we asked the fan committee to come up with the definition for ducted and unducted fans. And this has to do with how it's tested. So a ducted fan is a housed fan tested with an outlet, according to AMCA Standard 210, installation type D or B. And an unducted one is a housed or unhoused fan with an outlet ducted according to AMCA Standard 210, installation type A or C.

MS. ARMSTRONG: Could we make this a little bigger?

MR. SMITH: Sure.

MS. ARMSTRONG: So without needing to discuss the ducted, the definitions and specifics, I think at a high level from my perspective it's not clear where a ducted fan definition or an unducted fan definition would be utilized. If the test procedure conditions are going to apply to a specific type of fan and they're going to tell you for these types of fans you use this as set up and that setup will include the presence or the absence of a duct --

MR. SMITH: Okay.

MS. ARMSTRONG: -- so I’m not sure, you know, if we need to spend a whole lot of time. I could be wrong, so this is helpful kind of --

MR. MATHSON: Yeah, Tim Mathson, I would disagree with that approach because, I mean a classic example would be an air handler manufacturer and a double-width fan. Normally, a housed centrifugal, if you classify that as a housed centrifugal, you would say it's tested and let's go. But why would the DOE prevent us from testing a double-width centrifugal, or an air handling application. I don't know why you would do that.

MS. ARMSTRONG: So I mean this gets back to our discussion last week, and I thought I heard, and perhaps you guys can correct me if I'm wrong, but you know, even manufacturers that make a fan that may be used with and without prefer to test it and rate it only as one way. Do you actually want to have to test and rate and comply with both configurations?

MR. MATHSON: No, this is Tim. We don't want, we don't want to do that. I'm saying that 99 percent of the time that double-width would be tested, as well as the duct.

MS. ARMSTRONG: Well, it's a yes or no, right?

You can't have it both ways. It's not going to be at your discretion?

MR. MATHSON: Why not? Why not? If the customer wants it?

MS. ARMSTRONG: Well, so that's different. I mean you can ask DOE to --

MR. MATHSON: If the application is going to --

MR. WOLF: Let me try because I was going to bring this up before. I think one of the things that I hear and I'm struggling with is what are we going to use for a rating metric, and then what are we going, how is, is that a mechanism that is going to be used to convey the components to the end customer?

MS. ARMSTRONG: Yes.

MR. WOLF: The answer to that is yes?

MS. ARMSTRONG: Yes.

MR. WOLF: So then in that case then we come back to Tim's situation.

MS. ARMSTRONG: Yes, that's where I was going with my thing. So I hear Tim asking, we want a standardized rating method but we also want a way to be able to make representations the other way.

MR. WOLF: Well, do it.

MS. ARMSTRONG: I don't know, I don't know the answer but the answer is you can't make representations of an efficiency metric that's not --

MR. DIKEMAN: Well, this is Steve Dikeman. Ashley, here are 90 examples of a house centrifugal fan that is never tested, rated or used with a duct.

MS. ARMSTRONG: Okay.

MR. DIKEMAN: I picked these up off of a testable configuration work we did last time.

MS. ARMSTRONG: Um-hmm.

MR. DIKEMAN: The product falls into a definition --

MS. ARMSTRONG: Yep.

MR. DIKEMAN: -- of a housed fan, but it's never used that way. So if it doesn't have a duct connection to go test it that way to meet that description, then it just went down.

MR. BUBLITZ: So what's your recommendation?

MR. DIKEMAN: What we have to sort out is this ducted/unducted. What Tim Mathson said was that the manufacturer may choose, but I think there's also some product that says it's housed but it will never be ducted.

MS. ARMSTRONG: The DOE is not going to say you can choose because we want manufacturer A to choose the same way that manufacturer B is going to choose.

MR. DIKEMAN: There needs to be a requirement housed --

MS. ARMSTRONG: There needs to be a way -- right. So there needs to be a requirement in our regs that kind of dictates how you choose.

MR. DIKEMAN: To be housed?

MS. ARMSTRONG: The choice is I want to make representations of both configurations. You need to let us know if it's that there is a sliver of the market that we can define separately that need to make both, fine, then you need a definition, fan committee, or you know, maybe it's that you don't want any of that and you want to standardize. I don't know.

I mean another thing to think about is there, you convey the information to the customer in different ways. Is it just in the energy efficiency metric that you would do it, or is there other ways about the performance that you're talking about? Because I think that matters too.

So I don't think we can answer that today, but you guys need to think about what you want and how this applies, because the way it works is then DOE reg says we return a method that governs how you make representation to DOE, but that's a lot broader. Marketing, literature, customers, and they would need to be made in accordance with the DOE test procedure.

So if we go down the pathway, which is what I thought I heard last week so I'm glad we're having this, is to standardize the method, it would preclude you.

MR. SMITH: So since the beginning of time, right, the industry has developed giving the manufacturer the option of how they want to rate their product, A, B, C or D, with the requirement that they identify to the customer how the rating occurred in their rating tables?

MS. ARMSTRONG: Yes.

MR. SMITH: In spite of the fact that they have a choice, a very high percentage of the time manufacturers choose one approach. But as, and that I think has governed our thinking that we were developing in these ideas. But as Steve points out, in that sort of momentum of thought, we overlooked the fact that, no, there's a lot of members who represent their products to the marketplace based on a different rating method and identify that, which is, which is allowed under 210, and encouraged, truthfully, because we want the actual performance of the fan differs if it has a duct on it than if it doesn't.

And so I would just inject here that it's better if it has a duct on it. But if the fan is not intended to have a duct and its performance in an unducted application is the way the manufacturer wants to represent it to their customer because that's how their customer applies the product, then that's the appropriate thing to do. So somehow we have to make an accommodation, because if we don't we'll lose the utility of being able to provide honest ratings, not misrepresented ratings, but honest ratings to the customer.

MS. ARMSTRONG: And what we're, how that translates into a world where you have discretionary kind of things to deal with, you have the discretion to make ratings the way you want to the regulatory world, in which DOE is going to standardize things so that everyone is doing, using a similar method, and similar rating points, and making representations that can be comparable for the purposes of utility programs, et cetera, et cetera. You know, what that means is that if you want that, we need to figure out a way to accommodate that, but we would also, you know, if you decide this sliver should be rated both ways --

MR. SMITH: No, one or the other.

MR. DIKEMAN: Not both. Not both.

MR. SMITH: One or the other.

MR. DIKEMAN: It would be housed but not ducted.

MS. ARMSTRONG: Think about it a little bit more in terms of what you want. I mean however you want it, I don't care, and I think Tim was saying there are, there may be cases. You guys think about what you may want. But if the answer is I want both, then you would be subject to regulation of both.

MR. SMITH: Both.

MS. ARMSTRONG: Or potentially.

MR. SMITH: Right. Right.

MS. ARMSTRONG: That's a discussion we would need to have. But I mean you guys should speak up, in terms of ratings and what you want to see on ratings, and I think one of the things you're at the table is because you want standardized ratings. Those ratings that are sent into the department and people are seeking out that information more and more, and so not just what they would make in discretionary language.

MR. STARR: Yeah, this is Louis again. I think the other aspects of the whole loophole business is that people, I mean I think fan guys want the same thing. Wouldn't you be concerned if someone tested one way and rates it another? It's your --

MR. SMITH: Yeah.

MR. STARR: You think you're comparing apples-to-apples, but actually you're comparing something else.

MR. SMITH: Right.

MR. STARR: So that one guy gets the sale. So, I think it's equally, while it may seem like DOE is being a regulatory nitpicky, perhaps, but it's not and in reality you want, you want the same thing they want ultimately. So it's just something we work on.

MR. SMITH: Right, so this thing, I've got a centrifugal fan, it's sitting in front of me. The paradigm is that it's a housed centrifugal fan. The paradigm is that it's ducted. So how do we accommodate the manufacturer who employs that fan in a non-ducted application exclusively for their product, and therefore chooses to rate it in a non-ducted way. How do we make that accommodation, recognizing that there's -- well, I won't say this. I was going to say recognizing that there's no way to physically distinguish the product, but I think what I hear you saying is that we have to find a way to physically distinguish the product. And so in the definitions we need to find that way so we can put it in the right category.

MS. ARMSTRONG: So can I make a suggestion at this juncture? I know you guys have some feedback on the definitions. I'm going to actually suggest that before you ask your fan committee to take another deep dive with some of these definitions that you actually let DOE give it a shot based on what we heard today.

And the reason for that is two-fold. One is we've heard some what we think are pretty good intentions of what you meant. We are not by any means fan experts, but we understand how our regs kind of would be implemented.

And then two-fold, I can try to get some of my lawyers to at least look through and get first feedback, a little feedback on that, because you will see some significant changes that may make sense. And I think before you start, and I know you guys have put a lot of work into it, so why don't you let us give it a shot, if that's okay with you?

MR. SMITH: Sure.

MS. ARMSTRONG: Thanks. And then I do want to move to the NODA before it's too long. I mean anyone who has specific definitions in response to what we've talked about today, we welcome that. We can include them in all of our feedback and recommendations, so just send them our way. And then we'll obviously we'll distribute something for the group to further consider from there.

MR. SMITH: I think before you were here we talked about driver and this became a scope question.

MS. ARMSTRONG: Um-hmm.

MR. SMITH: And so for whenever it is that you want to talk about scope, we can revisit this driver question.

MS. ARMSTRONG: Okay.

MR. SMITH: Okay.

MS. ARMSTRONG: Sounds good. Thank you.

MR. SMITH: So there's also, there were DOE's proposals in the ASRAC, and you see the comments here. Fan committee was okay, okay, okay, change where the fan impeller is connected directly to the drivers. This is direct-driven fan. So there's some suggestions there.

MS. ARMSTRONG: Great.

MR. SMITH: And that so ends the discussion of definitions.

MS. ARMSTRONG: Okay. Thank you. So at this juncture I'm going to propose that we take a break, come back and we're going to load up and get ready to talk about the NODA analyses and walk through that.

So maybe 15 minutes or so, just so everyone has a chance if they do want to grab something to drink or something downstairs.

(Whereupon, a brief recess was taken.)

MS. ARMSTRONG: So it's 10:42. We're going to do a good, solid hour-plus on these slides and see how far we get with these. This is your opportunity to ask questions about the NODA that has been put online as well as like how we do things, if you need to find something in the spreadsheet but can't figure out how do you find things, this would be your opportunity to those individuals that created those spreadsheets. So use this as such a thing. We're going to go through this. We'll break for lunch. We're going to continue and finish it and my hope is that we can get through all of this, we're going to plow through it, as well as revisit the ratings discussions yesterday because I had a lot of questions about it. So, just continue that round table before we finish up at three. So, with that I'd asked Sam today to just keep going unless there are specific questions. Okay?

MR. JASINSKI: Thanks, Ashley. Sam Jasinski, Navigant Consulting. I'll be talking today about the NODA analysis. These are pretty barebones, similar to what was published. It's really just to get the tools and the data and information out for your review. But if you remember, so these will be from the May 1st NODA results, the most recent, but I believe we also have these updated to reflect the static versus total efficiency for ducted and unducted fans as was discussed in previous working group meetings. So the scope of the, if you remember, just to provide some context, if you remember in one of the earlier working group meetings we showed that DOE by statute has to account for certain factors, I think there are seven of them. Typically DOE has one or two analyses to consider each of those factors. So you'll see this presentation organized around those analyses and we'll go through each of them. So that's the organization of the presentation. Okay, to kick things off, the scope of the May 1st NODA included the fans you see here which we've talked about it a lot. Fans that were included, axial, centrifugal, inline and mixed flow, radial, power roof ventilators. Fan types not included in the analysis, safety, cross flow, circulating, induced flow, air curtains. And the scope was limited. The fans in this analysis had a maximum shaft input power of at least one horsepower but not greater than 200 horsepower at max speed. Did you have a question?

MR. BUBLITZ: Mark Bublitz, New York Blower. So we can conclude that that is the list of fan categories under which you conducted your analysis and every fan that would qualify would fall in one of those buckets?

MR. JASINSKI: Yeah.

MR. BUBLITZ: Thank you.

MR. JASINSKI: Well, the caveat is, all fans for which we have information to conduct the analysis fell into those buckets, yes. If that makes sense.

MR. BUBLITZ: Makes sense but it's not clearer.

MR. JASINSKI: Okay. Let's, we're going to talk a lot about our data sources and I think you at least will be very familiar with most of the data that we used. So, it should be clear to you and maybe you can help me articulate it to the rest of the group who might be having, who might be similarly confused. I'll let Sanaee actually speak to this slide.

MS. IYAMA: So, here is just to kind of give an overview of the, of the main dataset that we used to run the analysis on. So this data, this data set that we later called the LCC sample was developed based on aggregated, sorry, based on 2012 AMCA sales data and we filtered the data to adjust it to the scope that Sam just presented. So, you know, looking at fans over one horsepower and below 200 horsepower within the categories that were listed as in the scope of the analysis. Doing that, we ended up with about 70,000 fan selections, representing about 100,000 units sold and this is what you see on that graph here and the size of the bubble kind of represent the volume on the market.

MR. JASINSKI: They're kind of hard to see but the axes here are total pressure on the Y-axis and flow the X-axis. Yes?

MS. PETRILLO-GROH: Laura Petrillo-Groh, AHRI. Does this include the entire fan or just the impeller?

MS. IYAMA: So these are fans meaning impeller housing, structure when they were --

MR. JASINSKI: As they were sold. These are fan sales, correct?

MS. IYAMA: Yeah.

MR. JASINSKI: So, as they were sold.

MS. PETRILLO-GROH: This data would not represent any fans in packaged units where they were built, where the impeller was purchased and embedded in the unit by (indiscernible)?

MS. IYAMA: So, some could actually go later on or be sold to manufactures. I think that's what Wade had mentioned; that some of these fans in the database that AMCA provided could also be embedded fans, right?

MR. JASINSKI: But are any of them just the impeller itself?

MS. IYAMA: No.

MR. ROY: I guess -- Aniruddh Roy. I guess a follow-up to Laura's question is, in this data set, do you ever take let's say a rooftop and maybe extract the fan from there and then conduct a test?

MR. SMITH: Can I answer that?

MR. JASINSKI: Wade.

MR. SMITH: The database from AMCA members and the fans that are included include a lot of fans sold in 2012 to manufacturers of air handling units and large unit carrier equipment. I feel that the backward inclined fan data is in the database, the data that's in the database is representative of the full market including embedded fans. But I believe that while some of the FC fans may be embedded two things can be said. Number one, the number of FC fans that are in the database is a very small number and number two, I believe it is not representative of the embedded FC fans. All right? So, mentally, the way I have thought about this data is that the forward curved fan data is a small sample, it's much smaller than I would like, it's not representative of the market, it's certainly not representative of fans embedded inside equipment, forward curved. With backward included and airfoil fans I feel that it does represent and the market expansion that we did since the database isn't the full market, it's just the market that was reported to us. We then expanded that to represent the full market and in that expansion I’m quite comfortable that we captured the imbedded fan market for backward inclined fans. Okay?

MR. ROY: Thank you.

MR. SMILEY: Bill Smiley of Trane, I have a question, actually have two questions. First one should be easy. But I noticed the total pressure you have here goes up to 140 inches of water and with our definition that we've tossed around and I think finally agreed on since day one, the max pressurized would be like 40 inches. So, I wondered if you --

MR. SMITH: No, it's 120.

MR. SMILEY: 120? 1.1 pressure ratio is 120 inches?

MR. SMITH: It's over 100, let's put it that way.

MR. BUBLITZ: It's the 25 --

MR. STEVENS: It's 1.3.

MR. SMILEY: That's 1.3, not 1.1.

MR. SMITH: Well, 25 kilojoules is --

MS. IYAMA: So, I think, you know --

MR. SMITH: -- over 100.

MS. IYAMA: -- these were analyses that were done before all --

MR. SMILEY: Oh, okay.

MS. IYAMA: these discussions happened so --

MR. SMILEY: So you haven't done --

MS. IYAMA: -- so we would, if we were to redo this with whatever the working group agrees that should be in or should be out we would address that dataset again.

MR. SMILEY: Okay.

MR. WHITWELL: Bob Whitwell of Carrier, oh sorry, Bill, go ahead.

MR. SMILEY: Go ahead.

MR. WHITWELL: No, you finish. I thought you were done.

MR. SMILEY: Well, okay. So, we might need to discuss it a little bit further. I mean, I really don't care about the pressure, pressure issue at least. It seems 1.3 is a little high for a fan. You're getting into compressor stuff.

MR. SMITH: It's just that, Bill, it's the accepted definition in the AMCA literature, in European literature.

MR. SMILEY: No, what I saw was 1.1 but that's okay. We don't need to -- the other question is, for every dot that's on there you have information on the fan that included cfm and total pressure apparently, fan power and RPM and that kind of stuff, correct, in the database?

MS. IYAMA: So we have, the information that we have in the detailed list of all the variables that we had is in the LCC spreadsheet. We can go through that but it was mainly, flow, pressure, static and total --

MR. SMILEY: Yeah.

MS. IYAMA: -- you know, design point --

MR. SMILEY: So you're able to plot flow and pressure for every fan that's in the database that you analyzed --

MS. IYAMA: The fan selection.

MR. SMILEY: And what you just told me, you told us that every fan that's in this database, a lot of them were sold to manufacturers that embed them in other products. And I'm wondering how the fan manufacturer knows the flow and pressure points specifically for all those fans that are going to be imbedded in other products. So --

MR. SMITH: Because --

MR. SMILEY: -- is it a guess, a best guess or what?

MR. SMITH: No.

MR. SMILEY: I mean, when we --

MR. SMITH: Can I answer the question?

MR. SMILEY: Sure, please answer the question.

MR. SMITH: Okay. So, there is some data in the database which does not have the flow and pressure information and that is where there's a query on the database that requires that information. Those lines are ignored.

MR. SMILEY: Right.

MR. SMITH: Most of the embedded fans that are sold and included in the database are purchased from the fan manufacturer with a flow and pressure and that data then is available and if it's available it's in the database.

MR. SMILEY: Well, okay. It just surprises me that we would order a fan from a fan supplier and tell them, we want this fan and, oh, it's for this flow and this pressure.

MR. SMITH: You don't and none of your data's in here. But other companies do and they do exactly that.

MR. SMILEY: Well, that's good to know then. Thank you.

MR. WHITWELL: Yeah, so Bob Whitwell, so just to follow-up on that, Wade. So, you said forward curved you think is under represented here so I assume that those are forward curved fan components that are sold to people that then put them into their units with, and put their own housing?

MR. SMITH: Well, they're not in here so I don't know --

MR. WHITWELL: Yeah, they're not in here, right. So they're not in here so there's a lot of those that are not in here.

MR. SMITH: Right.

MR. WHITWELL: And how about panel fans where the manufacturer sells just the blade and that gets put into the product? I assume there's a lot of those that are not in here as well?

MR. SMITH: Well, those, in our world those are not fans and they're not in here.

MR. WHITWELL: Right. Okay. So, based on the definition of fans that we're talking about they're not in here?

MR. SMITH: However, right, in each category we took the data that we did have, right, and we said, all right, what percentage of the market is the data this represents. So we looked at the total market and then when determining savings or non-compliance rates as an example we grossed up what was in the database to represent to the total market. And in the case of panel fans in particular that grossing up was quite large. In other words, there's a lot of unreported panel fans, not reported to AMCA for a statistics program, certainly not reported to the database.

So, we took the, a market estimate, an expanded market which by definition is an estimate because we have reported markets, right, and then we have the unreported. And so the expanded which includes the unreported data by category was sitting off here to the side, all the data was sitting off here. So, if we're asking a question like non-compliance rate, well, I don't know the non-compliance rate of the market that wasn't reported to me but I do in the market that was. And so the question then, is well, okay, what's the answer, take an order of 15 percent non-compliance rate, right, okay. So I have 15 percent non-compliance rate in the database, is the database large enough to be a statistically significant representative of the total market and that's a judgment call that's made one product category at a time. But in every fan category except for forward curved fans we feel like the database is representative of the market.

MR. WHITWELL: Okay. You went way beyond my question. I was just trying to understand the 10,000 versus what my thought is about the number of fans they use.

MR. SMITH: There's a lot of panel fans that are not in the database but the database is a statistically significant representative of the total market.

MR. FLY: Mark Fly with AAON. I think there's also probably a lot of BI and BC fans, I don't think you've really got the majority of them. I, our company uses those almost exclusively, we never buy a complete fan, I don't think that's unusual for major manufacturers. The people in the custom business do tend to buy complete fans. And so when you're selling to a fan manufacturer you're probably leaning heavily on that side of the business as opposed to the more standardized commercial products.

MR. SMITH: Right. So I'll just tell you what we did.

MS. ARMSTRONG: Well, can I turn it over? So, I think this is a whole, what we're here to do today though is explain to you the NODA and I think that we would welcome data. I mean, if you believe your fans with the data that we have used so far, I mean, are not incorporated in some manner or form or not represented we would welcome that, we'll include them, no problem. This is just draft analyses as you know. The reason for presenting it to you today is to get feedback on its refinement, so this discussion I think is helpful but I do want to make sure we get through some of the technical aspects of exactly what type of data sources. But like I said, if you bring data to the table I’m happy to incorporate into one of those analyses for your use and the working group. That's the whole point of this.

MR. FLY: Okay.

MS. ARMSTRONG: Thank you.

MR. JASINSKI: Okay. I'll move on. I'm going to skip this for just a second but I'll come right back to it. So, the first analysis I wanted to talk about is the engineering analysis. The purpose of the engineering analysis is to characterize the relationship between manufacture and production cost and more efficient fan designs. We're essentially trying to figure out the incremental cost to the manufacturer, the per unit production cost for a more efficient design. The first, this is just a quick overview of that analysis. The first major step is to select efficiency levels which is the previous slide which I'll go back to. DOE identifies the baseline, in this particular, that represents the least efficient fans. In this case that means that we used an efficiency level that was achievable by most fans in the AMCA database. DOE also identifies a max tech. This represents the most efficient models. For this particular analysis this means that we picked an efficiency level that retains some fans in each type of, of each type in the AMCA database. So, see we just tried to bound the data that was given to us in terms of the least and most efficient fan models. And then DOE also selects intermediate efficiency levels. In this particular NODA we selected levels between the baseline and the max tech and you can see them here. EL0 would be the baseline, EL6 would be the max tech. You can see the efficiency targets associated with those. And the, a target of 62 percent was used to present results for ducted fans in AMCA's DOE fan efficiency proposal presented at the 59th AMCA annual meeting. So there's a public, they use that publicly. So you can see we used efficiency levels above and below that but we wanted to make sure that that one was represented. You can see that it's an EL2. Do you have a question in the back?

MR. SMILEY: Real quick question. Was this -- Bill Smiley, Trane. Was this base on peak efficiency of the data that you had --

MR. JASINSKI: Go ahead, Sanaee.

MR. SMILEY: -- or efficiency of the actual points that you're analyzing?

MR. JASINSKI: Efficiency --

MS. IYAMA: So --

MR. JASINSKI: Go ahead.

MS. IYAMA: Good point.

MR. SMILEY: Thank you.

MR. JASINSKI: So, these are the efficiency levels that were selected and you'll see them through the rest of the analysis. Yes?

MR. FLY: Mark Fly with AAON. Is this, for these efficiency levels, is this expressed in efficiency for all fan types or is it split up by --

MR. JASINSKI: No, it will be --

MR. FLY: -- per types of fan?

MR. JASINSKI: -- you'll see fan types or equipment classes analyzed.

MR. FLY: Okay.

MR. JASINSKI: So each of these --

MR. FLY: Each one is analyzed individually?

MR. JASINSKI: Yes.

MR. FLY: Okay.

MR. JASINSKI: And Sanaee, I believe there's a different set of these for static?

MS. IYAMA: Yeah. So this is just, again, the May 1st NODA where we did everything with total pressure and metric using total efficiency.

MR. JASINSKI: Okay. So you'll see another set of these later on in the revision that includes static.

MS. IYAMA: Right. And these are the targets, right, and then depending on the operating point you'll have that equation with the de-rating factors, right. That's just the target used in the efficiency equation.

MR. JASINSKI: In the metric that was discussed at the last meeting.

MR. MCCABE: Michael McCabe, could you explain again the EL6, the max tech and how that compares in the specific class to the best available?

MR. JASINSKI: EL6, the way the max tech was selected here was we looked at the AMCA database of fans and we pushed it as high as it would go without eliminating an entire fan type essentially which means that every fan type included in the analysis there is a selection of a fan type in the analysis for each fan type that can meet this level. Wade?

MR. SMITH: I sent an e-mail that everybody got but I just want to reiterate that the non-compliance rates that are shown up there are quite different than the non-compliance rates we've calculated. So, we're working off the same database nominally so we need to try and reconcile it --

MR. JASINSKI: Right.

MR. SMITH: -- we're going to do.

MR. JASINSKI: Yeah. And I think it's, we can come back to these. I think it's, I think the rest of this presentation will provide some context to those numbers. So, we're getting a little ahead of ourselves. The other thing to remember again is that this is just what was done here. If the working group decides that max tech should be higher or lower then we will consider that as well as any of these other efficiency levels. This is just what was selected for this particular analysis.

MR. WAGNER: Before you go off that, this is Greg, you have that EL6 at 86 percent. Does that, let's look at axial fans, are you saying any type of axial fan or are you saying panel fans can reach 86 percent?

MR. JASINSKI: I believe that it only means that there is an axial fan that, there was an axial fan in the database that could meet that efficiency level.

MR. WAGNER: So that's a vane axial fan is what you're saying?

MR. JASINSKI: We can look. I don't believe that we tried to preserve every subgroup. I think it was simply in the equipment classes that were used in the NODA, if there was a fan sold that could meet this efficiency level in that equipment class then --

MR. WAGNER: Well, it might be useful to know what that non-compliance stands for, composed of for each of those EL levels because that might be important.

MR. JASINSKI: Okay. Sanaee?

MS. IYAMA: So, Greg, if you look at the LCC spreadsheet, if you guys want to know what these numbers would look like, whether it's by category code or fan category, category being the subcategories, all the data is in there. We just didn't put it all on the slides. So I think maybe we could just move on and then maybe later dig into the details.

MR. JASINSKI: Sounds good to me. Any other questions before I move on?

MR. MATHSON: Well, this is Tim Mathson, I think we're just a little confused and this confused me too when I first saw it. But this 86 percent that Greg asked about, you know, you think well how can, there's a 47 percent non-compliant, well how can the 53 percent actually comply with that. But this is that number before it's de-rated.

MS. IYAMA: Yes. That's just the target.

MR. MATHSON: And this is just an extremely high-pressure, high flow type of a fan. There probably wasn't a fan in the database that met 86 but the requirement was somewhat lower than that.

MR. JASINSKI: Right. What Tim's pointing out is that the efficiency target here is represented as a single value but in the metric that we use it's actually a continuous curve de-rated by pressure and flow. So, for a particular, for some of the fans in the database, depending on the operating point, the target efficiency would not be 86 percent.

MR. DIKEMAN: I understand.

MR. STARR: This is Louis with NEEA, one thing I should ask, just, I forgot what you call it now, it's not PBER (phonetic sp.) but the metric, whatever that --

MR. SMITH: FER/FEI?

MR. STARR: Yeah. Is there a lower limit on it to where the results don't actually, like on FEG it was five inch impeller? Is there something on that on the FEI/FER metric, is there a lower number? Does it go all the way down? I mean, there must be a lower limit somewhere.

MR. MATHSON: There's no diameter in it.

MR. SMITH: It's just --

MR. STARR: Are the answers so realistic? I mean, they're pulling the numbers from the database, they can have some, I don't know, probably worth someone taking a look at it I would say.

MR. SMITH: I would just say that we focused our energy, our energy --

MR. STARR: One horsepower.

MR. SMITH: -- one horsepower and up and we selected data on fans below one horsepower and used that data to say how big is that market, how many fans, what types, blah blah blah blah blah. But we used that data to sort of guide our advocacy to one horsepower and up and then thereafter we did a lot of analysis on the one horsepower up, so.

MR. STARR: All right.

MR. BURDICK: This is Larry, I've got a question still. On the EL6 then, so that, the efficiency is obtainable using the 250 adder on the flow and the .4 adder on the static?

MS. IYAMA: So, I think there is maybe a confusion in the way that this, these ELs are presented. So maybe I'll try to clarify. We presented in the last meetings that efficiency equation which would be the minimal efficiency that you would have to meet at a given flow and pressure. In that equation you had an efficiency target which was a constant which kind of reflects the, how high that 3D surface would be relative to the pressure axis, efficiency axis. And then there was also a pressure de-rating function which was, you know, the pressure over pressure plus the pressure constant, 0.4, and then you would also multiply that with the flow de-rating function which was flow divided by flow plus a constant.

MR. BURDICK: Which is 250.

MS. IYAMA: Which was 250.

MS. ARMSTRONG: So you're seeing a single point, but what it's really, what we really do is get the point on the entire span which aren't going to be the same as that number once you go across the entire span of pressure and flow. So that number is just the --

MS. IYAMA: That number is the constant in that efficiency equation before it's de-rated.

MR. BURDICK: Right. But in the end aren't we going to end up with, or is the intention to end up with a value that's FEP type factor or are there going to be these

EL levels. So what's going to be the --

MR. JASINSKI: The purpose of this is just to show that we analyzed a range of efficiency levels. In order to show what we're trying to say this table would have to have pressures and flows across a ridiculous range and there would be a different efficiency target numbers in every one of those cells. So this is, you can just, you know, I would ignore the efficiency target column.

MS. ARMSTRONG: Get on the flight. So at the end of the day the standard will be a function of pressure and flow. So you're not going to see a single number in a hard line.

MR. SMITH: It's the format.

MS. ARMSTRONG: It's what we've discussed, the format of the metric and format the standard will take will be a function.

MR. JASINSKI: The point is that the analysis calculated results for everything from the least efficient fan, a level for least efficient fans up to the most efficient fans and a lot of increments in between.

MS. ARMSTRONG: Right.

MR. WOLF: So, the metric itself is going to be the FER or FEI --

THE COURT REPORTER: Can you speak up?

MR. WOLF: The metric is ultimately going to be this FEI or FER and what I envision in my head is a 3D surface or in a 2D --

MS. ARMSTRONG: The bubble.

MR. WOLF: Yeah, I see the bubble.

MR. JASINSKI: Yeah.

MR. WOLF: And what might be easier for me to understand anyway is at the different levels what was the, you know, starting level, I'm assuming level one is 1.0, I'm making that assumption, I could be wrong.

MR. JASINSKI: 1.0 --

MR. WOLF: Is what the initial target --

MR. PERSFUL: Index.

MR. WOLF: -- index is going to be.

MR. JASINSKI: No, I don't think it, it would be better to not think of it in terms of the index. It would be better to think of it in terms of the FER equation as presented by AMCA.

MR. WOLF: Okay. Well the FER equation drives to a number of right now 1.0, right?

MR. SMITH: Just get to your point because I think, what's the question though, related to the --

MR. WOLF: Well, I'm wondering, you know, what we're thinking as we move forward, the level zero is going to be sea level as we talked about and as you move up it's going to be 1.1 or 1.2 or I'm just trying to get a feel for it.

MS. MAUER: So I think, Mike, the standard, if we did an index the standard that we'd end up setting would be one.

MR. WOLF: Okay.

MS. MAUER: So but here we're figuring out --

MR. WOLF: Okay, where that means.

MR. JASINSKI: Fundamentally it's increasing in efficiency. So once the efficiency levels are selected for the engineering analysis DOE then models the manufacturing and production costs. First, DOE selects representative models, expand the range of equipment class, fan type, size, efficiency, manufacturers, et cetera. Then DOE generates bills of materials. These are based on physical and virtual teardowns, essentially deconstructing a subset of the models to evaluate what it costs to the manufacturer to produce a piece of equipment.

MR. WOLF: Sam, can I ask?

MR. JASINSKI: Sure.

MR. WOLF: Do you do that by the product classes (indiscernible) or --

MR. JASINSKI: Yes, yes. And finally the manufacturer production cost is estimated using a cost model that uses those building materials as an input. The cost model includes assumptions for things like production volume, labor rates, real estate values, et cetera, et cetera, et cetera, et cetera. And finally I put the last one in blue because it's a little bit of a deviation from what's typically done in rule makings but as we found out in this industry the incremental manufacturer production costs may not necessarily, it might be zero when going from let's say a forward curved fan to a backwards inclined fan. Now this is the manufacturer production per unit cost. Once all the redesign has been done, once all the investment in R&D and any new production equipment is done, after that the cost to the manufacturer per unit to produce maybe a higher, a generally more efficient fan using a backward inclined blade, it won't show up in the MPC compared to a forward curved blade or it won't be, it won't be significant. And so similar to what was done on pumps, because we understand that the majority of the cost to make more efficient fans is in aerodynamic redesigns which include product conversion costs related to testing, R&D or capital conversion costs which are related to investments you'd have to make into your production facility in order to produce more efficient fans, for this engineering analysis those redesign costs were included in the cost efficiency relationships. And I'll get into more details about that. But first we estimate the number of redesigns required at each efficiency level. We also estimated the per model redesign cost and with those we calculated the total redesign cost at each efficiency level. And as I said before we include those in the cost efficiency relationship and I'll explain how in just a minute? Bob?

MR. WHITWELL: Yeah. Bob Whitwell from Carrier. So, Sam, I want to take this down a rabbit hole but in our comments in response to the NODA we made some comments that the manufacturer and production cost and the redesign cost didn't take into effect, into consideration the impact on fan users to redesign and also the extra costs associated with putting more efficient fans in their equipment. And now after the meetings of this and now that I understand that I am a fan manufacturer as well I'm even more concerned about it, especially if it means that in order to meet a higher efficiency level we have to use a bigger fan. That means our equipment gets bigger, that means it's harder to replace and we'll get into conversion curves like the discussion that we've had in the other working group and we get into not only having to redesign the fan but then we also have to requalify that in our equipment --

MR. JASINSKI: Sure.

MR. WHITWELL: -- which can be a very expensive, time consuming effort.

MR. JASINSKI: Sure.

MR. WHITWELL: So I think going forward that needs to be some of the consideration based on the direction that this working group is headed.

MR. JASINSKI: What I would recommend is that, I'm assuming there are other people in this room who have similar concerns or maybe different concerns. When we go through this, look at this as how do I articulate those concerns to DOE, this provides that answer. So, while I might show you a cost, a cost assumption for testing time, if that, don't look at that as DOE hasn't accounted for me. Look at that as, if I want DOE to account for my concerns in that area that's the number I need to give them that reflects my situation.

MS. PETRILLO-GROH: Sam?

MR. JASINSKI: Yes?

MS. PETRILLO-GROH: Laura Petrillo-Groh, AHRI. DOE has these numbers for all the regulated products, I mean, there's been an engineering analysis on unitary equipment, the list goes on and on. And in every single one of those engineering analysis that has been conducted they looked at the impact, the financial impact and the engineering impact of incorporating a larger fan into the product. I would suggest that while we work on our data, DOE go down and just look at all those rule makings and incorporates that financial burden and engineering burden into this.

MR. JASINSKI: I can assure you that if that is the case we will absolutely be doing that.

MR. BOSWELL: So, one correction, the analysis that's done is not specifically looking at a larger fan.

MS. PETRILLO-GROH: Correct.

MR. WHITWELL: It's looking at higher efficiency levels or whatever the metric is.

MR. JASINSKI: Right. The other --

MR. WHITWELL: So the larger fan is a completely different thing.

MS. ARMSTRONG: And to date we didn't, so this is where your feedback and actually looking at the spreadsheets is key because to date we didn't find any situations for which increasing the efficiency of a fan, at least in our dataset, would require a change out in terms of the size.

MR. WHITWELL: Right.

MS. ARMSTRONG: So we kept the sizes the same. So it wouldn't have those downstream impacts. Now, we may get to a situation where that's not the case and we do need to then, and then we can look at other things. But I don't think it's necessarily one to one between the other engineering analyses. We may have that data or could generate that data from data we have other rules but it's not necessarily one to one on the impacts because they are looking at slightly different things.

MR. WHITWELL: It may not be one to one but it ought to be kind of directionally correct.

MS. ARMSTRONG: Right, that's what I mean.

MR. WHITWELL: For example --

MS. ARMSTRONG: We can do that --

MR. WHITWELL: Yeah.

MS. ARMSTRONG: -- but, I mean, fundamentally this analysis as you see it in a NODA did not change size. Those impacts would not occur, period.

MS. PETRILLO-GROH: Sure.

MR. WHITWELL: Okay.

MS. PETRILLO-GROH: But actually there's --

MS. ARMSTRONG: So, I mean, that's where your data comes into play. If there's data that you have on your, you know, to include in that fundamental data set that would show otherwise then that's when we would need to --

MR. WHITWELL: Right, understood.

MS. ARMSTRONG: -- account for and we haven't had a need yet.

MS. PETRILLO-GROH: Ashley, I’m a little confused how the data that we're going to collect would actually be able to answer that question of increasing efficiency of the fan --

MR. JASINSKI: Well, you'll see later on. We'll get into some questions about how we built the logic model to determine when a fan was redesigned, when it was reselected, your input on how to construct that logic model for your particular equipment or products is where we would account for that. So that's what I was saying in terms of, you know, instead of, it's important to understand what was done and what was in and what was out and all of that. But the other thing is that this is probably going to go through a lot of changes and we are going to, DOE is going to rely on your feedback to execute those. So if you want this analysis to tell your story accurately look for the levers that need to be pulled in order to do that. There will be mechanisms in here that will allow for us to account for those things even if they weren't necessarily executed or implemented in this particular analysis the way you would like them to. Recognize that they could and that there's data that we need or information that we need in order to do that.

MR. DADDIS: I'm Duane Daddis, Carrier. You mentioned that the size wasn't changed. Did we look at different fan types? Still a lot of testing to change a fan type I guess --

MS. ARMSTRONG: Yeah, so I mean I get that but so there are different costs and considerations. So you should make sure you're comfortable with some of the things and how we implemented but I did want a caveat that the dataset that we have we were otherwise able to find a more efficient selection to go in without changing the size.

MR. WHITWELL: And that's all the way up to EL6?

MR. JASINSKI: Yup.

MR. WHITWELL: Okay.

MS. ARMSTRONG: Yep.

MR. STARR: So this is Louis with NEEA. So, two things, first one, it sounds like when the manufacturers go back with a new equation and stick it in they'll see whether the return fans and supply fans change size and they can stick in the EL levels that you've put in the for the various levels and stick that in and see between fan size and once they do that they'll know if it's going to affect their casing if they just did it on commercial AC or have an idea --

MR. JASINSKI: So with the tools we provided the manufacturer won't be able to tell whether to change size. The way it works now is it will just say that it is, it passes EL0, 1, 2, 3, 4, and if the --

MR. STARR: So it's not, they don't have the equations or the equations not available? It's not the 250, or it's the --

MR. JASINSKI: Does the tool indicate whether it would be redesigned or reselected?

MR. WAGNER: This is Greg. One of the things to keep in mind is that the data that these manufacturers, and that was a big part of the message yesterday, is not the same data as what's being analyzed here. So their fan energy consumption efficiency numbers and all those kinds of things are based on a totally different operating point, different efficiency metric than what you would have shown in this analysis.

MR. STARR: I don't understand that.

MS. ARMSTRONG: I don't understand what you're saying either?

MR. STARR: Yeah.

MR. WAGNER: This data for fans and AHRI appliances, it's inside the box with all the other pertinences. So you have the system loss as well as the pressure drops through each of the each other different types of coils, filters and other items within that box.

MS. ARMSTRONG: I think we understood that and we kind of dealt with that yesterday by saying what do you want. And so that's where it's on you guys to come, I mean, yes you gave a presentation that at the beginning ended with, we think we should be tested in a box and then subsequent to that is, well wait a minute we think we might not want to be accounted for. And then subsequent to that is, well maybe don't want to be, we want to be outside. Anyway, long story short, it's more of a question about --

MR. WAGNER: Well let me --

MS. ARMSTRONG: -- what do you want at this point. So --

MR. WAGNER: Let me be more precise in what I’m saying. What I’m saying is those efficiency numbers shown a couple slides ago or a slide ago are based upon a fan only.

MS. ARMSTRONG: Yeah.

MR. WAGNER: Numbers, efficiencies or whatever performance metrics that they have to compare air flow to energy are not going to be in the same category. So saying, go back to your, and analyze this based upon your level of efficiency, we're talking apples and oranges. They're not the same, they're not the same starting point of how you measure efficiency --

MS. ARMSTRONG: Yeah.

MR. WAGNER: -- or how you can begin to say --

MS. ARMSTRONG: So --

MR. WAGNER: -- we have to --

MR. JASINSKI: Point taken.

MS. ARMSTRONG: You guys come back and said one that talks about a box --

MR. JASINSKI: So I'm going to keep moving forward. So, within the engineering analysis you'll see the fan groups to the left and these align with the equipment classes that were discussed --

THE COURT REPORTER: I'm having trouble hearing.

MR. STARR: I actually had another question. It's the last one on this one. It had to deal with, so you looked at changes between fans, types, did you look, so if I had --

MR. JASINSKI: We're going to get to the logic model --

MR. STARR: Oh, okay.

MR. JASINSKI: -- it will explain --

MR. STARR: All right, I'll wait.

MR. JASINSKI: -- when a fan was deemed non-compliant with the level. We have a logic model that says, okay, within the same fan type and within a certain tolerance of the performance point and at the same size, is there another fan that was sold where it could just be reselected.

MR. STARR: Okay. So in other words if you had, let's say you had a given EL level, you had a fans that had a number of design points that you have a new or higher EL level, now you only have, you know, five of your fan selection will fit so essentially you have to redesign your fan line.

MR. JASINSKI: Well, that --

MR. STARR: Did you get into that or not really?

MR. JASINSKI: That is where we need feedback --

MR. STARR: Okay, got it.

MR. JASINSKI: -- from the group to say, as a fan manufacturer if X percent of your operating points --

MR. STARR: Disappear.

MR. JASINSKI: -- are non-compliant would that trigger a redesign.

MR. STARR: Right.

MR. JASINSKI: And I believe the answer would probably be different for every different model for every different fan manufacturer. But, that is something that we would --

MR. STARR: Okay.

MR. JASINSKI: -- can and would like to include into the logic model to the extent possible --

MR. STARR: Yeah.

MR. JASINSKI: -- and to the extent agreeable to the working group. So, I'm having a hard time seeing these. Are they dark enough? Can people read these? So, you'll see on the left the fan groups. These align with the equipment classes as we've been discussing them. Within each equipment class DOE identified subgroups. Typically these were whether there was presence of guide vanes or not, different blade designs, and while it's, essentially these are subgroups to identify design changes that impact efficiency. And in general but it's understood not always, an airfoil is generally more efficient than a forward curved, et cetera, et cetera. And these are designs that we want to capture whether or not the manufacturer production cost of those designs should be accounted for in terms of making a fan more efficient. And so those were the subgroups that were identified and then you'll see the column to the right that we were, we had to tie these back to the database that we were given. And sometimes information to differentiate these subgroups was not available in the database and so the groups all the way to the right, the database categories are what were actually analyzed. So, for instance you'll see that in a database backward curved centrifugal housed and backward inclined centrifugal housed were not differentiated. So we analyzed them as backward bladed. In the centrifugal unhoused category there was no differentiation for the subgroups so all the fans within that subgroup were lumped together. And so you'll see results throughout this engineering analysis by the database category. In some cases we came up with intermediate results for the subgroups and then we had to combine those mathematically in order to represent a category where the subgroups were not differentiated in the database.

MS. PETRILLO-GROH: So, quick question. Laura Petrillo-Groh, AHRI. So when you said in the efficiency level was analyzed or the slide that the subgroups weren't preserved does that mean that there was a centrifugal housed fan that was --

MR. JASINSKI: The efficiency --

MS. PETRILLO-GROH: -- in each level or --

MR. JASINSKI: The efficiency levels were analyzed for each of the database categories.

MS. PETRILLO-GROH: Database categories.

MR. JASINSKI: Database categories. I'm sorry, no. The fan groups, each efficiency level was analyzed for the fan groups. The subgroups here are just a construct in the engineering analysis to identify designs that may have impacts on the manufacturer and production costs.

MS. PETRILLO-GROH: So, then it's, so sorry if this was already covered, does that mean for example, centrifugal housed fans max tech you might have lost all the forward curved fans?

MS. ARMSTRONG: It's in the --

MR. JASINSKI: Yeah, it's in the databases but I'm, I can't say with 100 percent certainty but I don't believe any whole subgroups were eliminated. Sanaee is shaking her head and she's pretty familiar with the database.

MS. IYAMA: Yeah, all of them.

MR. JASINSKI: Were not eliminated.

MS. IYAMA: We never reached a point where something disappeared --

MS. PETRILLO-GROH: Okay, thank you.

MS. IYAMA: -- off the market.

MR. SMITH: But to go back to that, apparently you did have circumstances where you replaced a forward curved with a backward inclined.

MS. IYAMA: Right. I mean, yeah.

MR. JASINSKI: In the LCC?

MS. IYAMA: When a fan was reselected, yeah.

MR. SMITH: At the same diameter?

MS. IYAMA: Yeah.

MR. JASINSKI: But not if there was another fan of the same fan type available.

MS. IYAMA: Yeah. So, I think we'll get to that. I mean, I don't know for sure that it happened but if they were, if the database had such fan then it could have.

MR. JASINSKI: Right. So there are some limitations here. We are, when we get to the reselection and redesign logic model I think we can go into those but I can tell that the group is already identifying some of the limitations of that database and that we would like to get feedback from the working group that may address some of those limitations. Yes?

MR. SMILEY: When you say fan diameter I think that they found that referred to a fan impeller diameter --

MR. JASINSKI: Yes.

MR. SMILEY: -- is that correct? Well, an FC fan impeller diameter and airfoil BI impeller diameter might be the same but the housing they go in might be totally different in size. So when you say we did the same diameter for the same diameter, changed fan types, so did you take into account any physical geometry size change --

MR. JASINSKI: Okay.

MR. SMILEY: -- might be something that needs to be considered.

MR. JASINSKI: Okay. If there are, you know, I'm sure there's a lot of variation but if there are general rules of thumb about how, you know, the fan housing, the ratio of the diameter of the fan housing to the impeller is different for, et cetera, that would be good to know and we can try to incorporate that to make sure that the overall size of the fan assembly or testable configuration does not increase this. That's useful. Thank you. Wade?

MR. SMITH: So, from the very beginning we have argued that the forward curved fan has a completely different utility that is unique and peculiar to forward curved fans and unique and different, a lot different, from backward inclined and airfoil. So, in our proposal to the advocates and to DOE and in all our comments we understand

and agree that backward inclined, backward curved, airfoil fans are different efficiency shapes of the same color but they don't behave at all like forward curved fans. They're different acoustically, they're different structurally, they're different RPMs, they're different vibration questions, they're completely different and Bill just pointed out that the physical size of the scroll that surrounds the wheel is also completely different. Substituting one for the other is a big change. You know, I want to say that the fan manufacturers very, very strongly argue that there's a difference in utility and that forward curved fans need to be a category unto themselves because their utility in the marketplace is peculiar and unique and not interchangeable with backward inclined fans. Having said that, there are applications where the exchange of one for the other is not material and to the extent that one might be more efficient than the other, we want to encourage people to move to the more efficient fan. But it's a gross mistake to suggest that all forward curved fans could suddenly become, or any forward, every forward curved fan could, if cost justified, move to a backward inclined. That's just not true.

MR. JASINSKI: Okay.

MR. SMITH: Okay.

MR. JASINSKI: So, I'll explain the implications of this type of grouping in that if they are grouped together then that would mean that when standards are set the same standard would be applicable to all of the fans in the subgroup associated. My understanding is that AMCA and the advocates wanted to go the ducted and unducted route and set the same standard for those groups. And so I'm just explaining --

MR. SMITH: It doesn't matter. It shouldn't but it does and here's why, here's when it matters. When you say a forward curved fan embedded in a product has become non-compliant and so to eliminate any impact that the increase in efficiency that's about to happen, to eliminate any impact on the casing we're going to preserve the diameter but then you change it to backward bladed, I’m sorry, you haven't preserved. You see what I'm saying?

MR. JASINSKI: Yeah.

MR. SMITH: You haven't done what you intended to do. Backward bladed fan --

MR. JASINSKI: Let me just --

MR. SMITH: -- of the same diameter is a different casing, different fan, different structure and different lot of things.

MR. JASINSKI: I understand. Let me just, I want to finish by saying that I was bringing that up to show that there are different ways to account for what you are talking about in the rule-making analysis. And I want to make sure that you're focusing on the right mechanism to do that. I was just explaining the implications of groupings so the equipment classes may not be the best mechanism for preserving what you're talking about. The logic model later on that determines when the impacts of a redesign or a reselection are estimated might be a better place for that. So it might be, could be --

MR. SMITH: That point is well taken.

MR. JASINSKI: Okay.

MS. ARMSTRONG: That's where feedback would be good, though.

MR. WOLF: So this could help me understand. What are you proposing relative to this slide?

MR. SMITH: Nothing. I just wanted to point out that --

MR. WOLF: All right. That's all I --

MR. SMITH: I wanted to put on the record an objection to (indiscernible).

MR. WOLF: So then the next question I've got for Sam is you're only doing the ducted and non-ducted, would that potentially be another column on here that helps us --

MR. JASINSKI: No. Where that would come in would be the test procedure.

MR. WOLF: All right.

MR. JASINSKI: So there would be, of those fan groups, some would be designated as ducted, some would be designated as unducted and that would have impacts on how they were tested.

MR. WOLF: This is --

MS. ARMSTRONG: So that first group would have ratings --

MR. JASINSKI: And the metric.

MS. ARMSTRONG: -- that are, would have ratings and efficiency levels that are analyzed based on their ducting configuration.

MR. WOLF: Okay.

MS. ARMSTRONG: Period. So this is where the earlier discussion matters.

MR. JASINSKI: Right. And the metric would be --

MS. ARMSTRONG: Right.

MR. JASINSKI: -- total versus static.

MR. FLY: Mark Fly with AAON. I'm still trying to get my head around some of this. When you looked at a fan and say that you decided that it was a non-compliant fan at some point of operation, some selection, and you looked for a fan to replace it with that was compliant are you looking at the same point of operation --

MR. JASINSKI: We --

MR. FLY: -- same cfm and --

MR. JASINSKI: There was a tolerance of what, 20 percent --

MS. IYAMA: There's a slide on this later on.

MR. JASINSKI: Yeah.

MR. FLY: Okay.

MR. JASINSKI: We're going to get there.

MR. FLY: I'll wait.

MS. IYAMA: Right now we're just talking about, you know, in the event where that fan had to be redesigned how did we estimate the cost of that redesign and that's it.

MR. FLY: Okay.

MR. JASINSKI: So, I think we're going to get to a lot of these questions and if we don't we can circle back.

MR. FLY: Right.

MR. JASINSKI: So, a little bit more information on how we calculate the manufacturer production costs. Like I said, we only conducted teardowns to generate bills materials. We did physical teardowns on roughly five units which represented four out of the 26 subgroups and then we did what we call virtual teardowns on the remaining subgroups. A virtual teardown is we would refer to specification sheets, drawings, any other information we can get our hands on in terms of identifying the types of, the components, designs, materials, processes that might be used and compare those to our physical teardowns. So, for instance, you can imagine if you did a physical teardown on a tube axial you could look at a schematic or a product literature for a vane axial and try to get into about those vanes that would allow you to incorporate the cost and make sure that the designs are similar everywhere else, that you could come up with an estimated manufacturer production cost for something that you didn't physically tear down just as an example. So we did a lot of those too to, because it's impractical to tear down every model of every fan type and every variation.

MR. SMITH: That's what we say about testing.

MR. WAGNER: Hey, Sam, this is Greg.

MR. JASINSKI: Yup.

MR. WAGNER: Question on the, how do you differentiate between high volume, low volume products and things like that because we make the same product, same size in two different methods and a low volume product line is significantly higher cost than a high volume product.

MR. JASINSKI: So, within the cost model that I discussed and is referenced in the second bullet there are assumptions made for production volume. At this time I believe the production volume is kept constant for all of the fan groups but that doesn't have to be the case. If we get feedback that certain fan groups are at a certain production volume than others we can certainly make modifications to that. For instance, if you look at the furnace fan rule I remember that some of those product classes were deemed high volume product classes and some were deemed low volume product classes and certain differences, for instance, in the assumed production volume were incorporated in the analysis to reflect the impact on manufacturer production costs as well as some other things. So that would be something that would be up to the working group if you wanted to provide feedback on the production volumes by fan group or subgroup or whatever else that would be very helpful for this cost analysis. So to the right you can see a diagram that tries to illustrate the process. As I said, we did physical and virtual teardowns. The raw materials, we evaluate the fabrication processes used to create finished materials. Anything that was purchased we also incorporate into the assemblies and then ultimately after we weighed, measured, identified the materials, processes used, we put those bills of materials into the cost model and it uses those inputs to estimate a manufacturer production cost. Here you will see an example of the outputs from that cost model to give you an idea of exactly what's included. The numbers here are just illustrative. On the left you can see the cost category. In the middle you can see the cost estimate. I believe this is for a centrifugal housed, either 22, I think 22, somewhere between 20 and 30 inches impeller diameter. And then to the right you can see a brief description of what's included in that cost category. So I know there's a lot on here. I can give people a minute to read through it. But this is also included in the NODA materials that are published on the DOE website if you want to take a look at those later. You can also get with me after the meeting or separately if you want more information about these.

MR. WHITWELL: So is this a fan without, with the housing but no motor?

MR. JASINSKI: This would be without the motor.

MR. WHITWELL: Housing, shaft, structure --

MR. JASINSKI: Yes.

MR. WHITWELL: -- fan.

MR. JASINSKI: Yup.

MR. WOLF: And what level of detail do you take this in -- I know that I probably should know that, but --

MR. JASINSKI: This is exactly what's on --

MR. WOLF: But I mean you take it into the product category or --

MR. JASINSKI: Yup. I don't know if it's included in here but there's a slide that we'll show that number that's at the bottom, the total, for every fan group, every efficiency level and I think we also included some representative diameters to show you what it would be at a given diameter. And I'll show you how we get to those different costs from the small subset that we actually did teardowns on. So that's what we're going to get into here. So this slide, just explaining how we developed the relationship between manufacturer production costs and diameter. So we used teardown results to characterize this relationship. We also did a series of manufacturer interviews to get feedback on this relationship and this is what we got. So you can see the form of the equation. MPC is a function of a constant A times the diameter plus the diameter raised to the power of another constant, B.

MS. PETRILLO-GROH: Sam?

MR. JASINSKI: Yup.

MS. PETRILLO-GROH: Would you be able to publish the, you know, any redacted version of the manufacturer impact analysis interviews or just distribute that to the group since --

MS. ARMSTRONG: We'll think about that.

MR. JASINSKI: Okay. I think that would be up to DOE. Any questions about this slide?

MR. WAGNER: Hey, Sam?

MR. JASINSKI: Yup?

MR. WAGNER: Sam, this is Greg, how many points were used to make that curve?

MR. JASINSKI: I'm sorry, can you repeat that?

MR. WAGNER: How many points were used to make that curve? I see two points on the screen but --

MR. JASINSKI: This curve was based on two data points but the curve form was based on feedback that we got from multiple manufacturers.

MR. DYGERT: Excuse me, I have a question.

MR. JASINSKI: Yes?

MR. DYGERT: Ryan Dygert, Carrier. So do you have a different curve for different types of fans I'm assuming?

MR. JASINSKI: Yes, that's on the next slide.

MR. DYGERT: Okay.

MR. JASINSKI: So this was for one fan type. On this slide I explain how we translated that relationship to the other fan types. So we established a multiplier, M, to adjust this curve to each subgroup. So it goes even in more detail than just by fan group. You can see the form of the equation there and we essentially took the same form of the equation and used it for multipliers to overlay that equation on the other virtual and physical teardown points that we had for the other fan groups to get the, or fan subgroups, to get the MPC equation as a function of diameter for each subgroup. And at the bottom right I've included an example. So this is centrifugal unhoused backward inclined. So we have the diameter of the CUBI fan as 20 and a half inches. The estimated MPC of this CUBI based on that green equation is, or I’m sorry, the estimated MPC based on the teardowns of the CUBI is in the second row there, $581 and change. The calculated MPC based on the equation I showed in the last slide which is the same as equation one here is $964.09. So the multiplier is just the ratio of those two to get the adjustment factor to get the general form of the equation to align with our teardown value of $581 and change. And this was done for each subgroup. Louis?

MR. STARR: Louis of NEEA. I noticed your fan wheel goes down to about 10 inches which is not exactly sure but somewhere between one and two horsepower. So, for anything less than that do you have any --

MR. JASINSKI: These are, to a certain extent I wouldn't look too far outside of the points that are shown on the graph. I think this was just for illustrative purposes.

MR. STARR: Okay.

MR. JASINSKI: Any other questions before I move on?

MR. SMILEY: One question. Are you, are we looking for some indication from manufacturers as to whether we think that curve's too high or too low and by maybe some sort of an amount?

MR. JASINSKI: Yeah. I mean, we're looking for feedback on everything. We're looking for feedback on --

MS. ARMSTRONG: I mean, obviously we welcome that. That's usually typically not something that we'll see at a public meeting, other than just --

MR. SMILEY: Right, it wouldn't be --

MS. ARMSTRONG: But to the extent people --

MR. SMILEY: It would be given to you guys.

MS. ARMSTRONG: -- wanted to do it in a private manner, especially a confidential manner, I would (indiscernible).

MR. JASINSKI: Basically anywhere you've seen a number, if you want to give us a different number we'll take it. If it's for all these categories, some of these categories, just that last number, these constants. If you want to give us data for any of this we will incorporate it.

MS. ARMSTRONG: The point here today is to show you what we have done to date which is this draft.

MR. MATHSON: Tim Mathson. I just, I know, Sam, you said I wouldn't use it too much beyond these points. I would, if you're going to go to the left I would say that point levels off.

MR. JASINSKI: Okay. Obviously.

MR. MATHSON: A size 12 and a size 13 cost the same amount to build.

MR. JASINSKI: Right.

MR. MATHSON: So, and I'd hate to go too far to the right.

MR. JASINSKI: I thought I saw one more hand.

MR. BUBLITZ: Mark Bublitz, New York Blower, I'm looking in the lifecycle cost spreadsheet and I’m seeing the result --

MR. JASINSKI: Okay.

MR. BUBLITZ: -- the consolidated number but I don't see the --

MR. JASINSKI: So there's a --

MR. BUBLITZ: -- factors by --

MR. JASINSKI: There's an engineering spreadsheet.

MR. BUBLITZ: Okay, an engineering.

MR. JASINSKI: So, it's in a separate spreadsheet.

MR. BUBLITZ: Thank you.

MR. JASINSKI: Yup. So, using those relationships we calculated the MPC individually for each of the subgroups. As I mentioned earlier, not all subgroups were differentiated in the AMCA database. So in those cases, we averaged the subgroup MPCs to be consistent with the fan categories in the AMCA database. For example, the AMCA database didn't differentiate between airfoil, BI and BC unhoused centrifugal fans so DOE averaged its MPC results for those subgroups to get a representative MPC for unhoused centrifugal fans. And then the last bullet point here, at each efficiency level we weighted the fan group MPCs based

-- or I'm sorry, for each fan group we weighted the fan group MPCs based on the distribution of subgroup shipments in the AMCA database. So, within a fan group, let me go back here to give you an example. So for instance, to get a representative MPC for centrifugal housed we weighted the MPC by shipments of airfoil, backward bladed and forward curved. If we had, if those were differentiated in the AMCA database. And this was the table I was showing you. This is the engineering analysis results. You can see all the fan groups to the left. Across the top you can see the efficiency level. M, this is that multiplication, the adjustment factor to get the curve. Then you can see some representative diameters and then you can see example MPCs for each of those diameters. And the reason that M increases with efficiency is that the distribution of the subgroups within those, within the groups gets more efficient essentially so that curve moves up.

MR. ERNST: So forward curved, this is Skip Ernst, forward curved and airfoil must be averaged or blended to get centrifugal housed?

MR. JASINSKI: Yes. So, the way I would read this table, because of how they were blended and averaged is essentially saying that DOE is estimating that in order to get a 20 inch diameter fan, let's say centrifugal housed, in order to get a 20 inch centrifugal housed diameter fan to meet a target efficiency of 87 de-rated by pressure and flow, to meet efficiency level two would cost a manufacturer $803 to manufacture that fan. That's what this table is saying. At that same efficiency level for the same group it would cost a manufacturer $1600 to manufacture a 30 inch fan.

MS. PETRILLO-GROH: Sam?

MR. JASINSKI: Yes?

MS. PETRILLO-GROH: Sorry, does this include the motor or not?

MR. JASINSKI: No motor.

MS. JAKOBS: This is Diane Jakobs. So why doesn't radial change for any of the EL levels?

MR. JASINSKI: So the reason radial does not change is because there were no, no subgroups identified in the AMCA database. So, it was, this is, this is exactly why we incorporated the redesign costs in the MPC is because we've heard from the industry that the cost of, the manufacturer production cost of generally more efficient fan subgroups may not be more expensive to manufacture. So, that may or may not be the case for radial. But the reason it shows up that way in our analysis is because the AMCA database did not provide any differentiation between the subgroups that were identified that might impact efficiency and therefore basically the manufacturer production costs at every efficiency level for a radial is just assumed to be the same.

MR. SMILEY: Bill Smiley, Trane. Sam, but what you are showing is if that's not the case you can adjust that --

MR. JASINSKI: Absolutely.

MR. SMILEY: -- because you've got the capability in your --

MR. JASINSKI: Absolutely.

MR. SMILEY: -- analysis to accommodate that.

MR. JASINSKI: Yes.

MR. SMILEY: But you just call that the data.

MS. ARMSTRONG: Right.

MR. JASINSKI: Right.

MR. WOLF: I believe you said that the redesign costs were factored into to the MCP.

MR. JASINSKI: No, no, no. The redesign cost is separate.

MR. WOLF: Okay.

MR. JASINSKI: It's factored into the manufacturer's selling price which comes up later in the LCC analysis. So this is only the cost to the manufacturer to produce the unit.

MR. SMITH: So in the database you've got radial fans to focus in on that one at many different peak efficiency levels and many different applied efficiency levels. And for each fan that was sold you have both. You also have the selling price. But obviously you don't have the cost. So you believe based on your interviews is that the cost to make an efficient radial fan and an inefficient radial fan is the same?

MR. JASINSKI: I would state it a little different in that we can't always show what we believe if we can't substantiate it in terms of --

MR. SMITH: But the feedback you got led you to this being what you believe is truthful.

MR. JASINSKI: This is our interpretation of the industry based on the information that we could gather or have been given.

MR. SMITH: Well, are you looking for feedback to suggest that this is wrong and there ought to be something different?

MR. JASINSKI: Absolutely. That was the point of this analysis. The point is also to show, it's also to show you when giving that feedback we, anecdotal we try to incorporate anecdotal evidence as much as possible but if you're telling us that radial fans at higher efficiencies will cost a manufacturer more to produce we need to know how much more, we need to know why.

MR. SMITH: So the --

MR. JASINSKI: We need to know --

MR. SMITH: -- form of the input that you're looking for is from a manufacturer who says, this is my manufactured cost on model Z and model B which are both radial fans in this category, model Z is much more efficient than model B, cost me more to make, here's my detailed cost sheets, you can compare, and that would suggest that your cost model at the different efficiency levels ought to look like this and not what it does?

MR. JASINSKI: Yes.

MR. SMITH: And it's anecdotal because they have, we make 10,000 of these fans and we make 2,000 of these fans and so it's not anecdotal, there's a lot of volume attached to these numbers but I've got two points because I make two radial fans. Actually, most of the companies that make radial fans make a lot more than two different ones.

MR. JASINSKI: Well --

MR. SMITH: But the point is that one company which makes multiple fan models that are different efficiency levels is in a position to answer you at a credible way to change these numbers, am I correct?

MR. JASINSKI: Yes. And the last thing I want to do is trivialize the feedback that you guys have given us. So when I mean anecdotal I just mean --

MR. SMITH: No, I --

MR. JASINSKI: -- qualitative is probably --

MR. SMITH: No, I --

MR. JASINSKI: -- a better way to describe it.

MR. SMITH: No offense taken.

MR. WOLF: So, go to the next slide, the next one.

MR. JASINSKI: The table?

MR. WOLF: So, help me understand rule-making process. Where does this data fit into that process? I guess to raise public question, is let's say for example the number you gave for those level two, for that centrifugal how it goes from a 20 inch fan $747 --

MR. JASINSKI: Right.

MR. WOLF: -- to $800.

MR. JASINSKI: Right. So --

MR. WOLF: What if that number goes to $8,000?

MR. JASINSKI: These results are inputs for downstream analyses --

MR. WOLF: Okay.

MR. JASINSKI: -- such as the lifecycle cost analysis.

MR. SMITH: Where else are they used?

MS. ARMSTRONG: Everywhere. I mean, the bottom line is this is deep down basic. This is the foundation of all the downstream economic analyses period. This is what's going to drive LCC, this is what's going to drive the MIA, at least in terms of the cost side of it this is what's going to drive the MIA. I mean, what matters is not the total cost, it's the delta. And then deltas get added to that later for other things. So maintenance cost, repair costs, selling price is going to account for your capital type changes that you need to make. But this is what's happening to your product. As we increase efficiency what happens to the cost of your product. That is a driver, the delta is a driver throughout. And so we're going to accrue costs at each, you know, at each of the analyses for different things. We're going to accrue savings.

MR. SMITH: Right. So, at the end of the day yesterday --

MS. ARMSTRONG: You asked about the --

MR. SMITH: -- I asked about the sensitivity and the reason is because when we sit down and say, well I don't believe those cost numbers, these cost numbers are more accurate. And if that's a material change to the outcome of the analysis then it becomes really important. But if it doesn't make a material change to the outcome of the analysis it's a lot of effort with no perceived benefit. I'm trying to, I'm trying to understand whether or not there's benefit zeroing in on this data or whether we should just leave it alone.

MS. ARMSTRONG: I don't have an answer for you yet.

MR. SMITH: Okay.

MS. ARMSTRONG: If there's, I would say if something looks fundamentally off you should raise it.

MR. SMITH: Right.

MS. ARMSTRONG: You'd be surprised how much incremental little things add up. But at the same time, nitpicking every cent is probably also --

MR. SMITH: Yeah.

MS. ARMSTRONG: -- not where you want to go.

MR. SMITH: Right.

MS. ARMSTRONG: If we're in the general ballpark, you know, I think we can agree to disagree but these numbers are typical but maybe not representative --

MR. SMITH: Right.

MS. ARMSTRONG: -- of any particular person.

MR. WAGNER: This is Greg. Taking a look at the axial fans, particularly the panel fans, why are any of them made at EL0 would be my first question because if EL6 costs exactly the same there shouldn't be anybody making the ones at EL0, is there?

MR. SMITH: You bet.

MR. WHITWELL: So, similarly --

MR. WAGNER: So, my point is, kind of what Wade said, I think there is a significance here that should be looked at because I can't imagine that axial fans are the same cost at all efficiency levels.

MR. JASINSKI: So this is cost to the manufacturer, not to the consumer. So, there might be other factors that, you know, factors in the market that require other types of, you know, model differentiation that don't impact efficiency and those would not be captured here.

MR. WAGNER: Well, could you describe that for me for an axial housed panel fan because I don't know what that would be.

MR. JASINSKI: Well --

MR. WAGNER: People aren't buying these necessarily on the street either but --

MR. JASINSKI: Well, maybe another fan manufacturer can help me out here.

MR. HARTLEIN: Yeah, this Dan, can you hear me?

MR. JASINSKI: Yes.

MR. HARTLEIN: Good morning. You know, there's a massive difference in the construction of a high efficient axial fan and what we might consider a commodity product. So, to Greg's point he's right. That's not representative. As the efficiency of an axial fan goes up the cost goes up quite fantastic. Trinity has a couple of pictures, or a couple of 90 percent axial fans that are like 90 percent efficient and you can see that the cost of those products are not relative to this equation. So it's a very, very different product. So Greg's point is correct.

MR. WHITWELL: Bob Whitwell from Carrier. I mean I think the same thing can be said about the centrifugal and how, I don't know if that's, if there's a typo there but how can it not be a cost difference?

MR. JASINSKI: So the reason you're not seeing cost differences, and I'll go back, is driven by the fact that the subgroups here are a list of design changes that we identified as generally impacting the efficiency of the fan. If those sub, if those design types were not differentiated in the database of sales that we had, there was no way with this methodology to account for those, those cost differences.

MR. SMITH: Well, they are.

MR. JASINSKI: Because we couldn't identify them.

MR. SMITH: Yeah, well, you've got three categories in the database here from the backward inclined and forward curved blades.

MS. IYAMA: I don't --

MR. JASINSKI: Well, he was talking about the centrifugal un-housed.

MR. SMITH: Oh, okay.

MR. WHITWELL: But I'm assuming that as you go from low efficiency to high efficiency, I mean that could go from a --

MR. SMITH: Flat blade to a --

MR. WHITWELL: -- flat blade to airfoil, right? That's the --

MR. JASINSKI: Well --

MR. WHITWELL: There's a big --

MR. JASINSKI: Sure. So we, so we identified that as a, right? We tried to identify that and if we had, if the database had those subgroups differentiated we could have captured that.

MR. SMITH: But the database doesn't have cost information anyway.

MR. JASINSKI: No, but it has, it, we can generate the cost from the tear downs. We can, we can look at --

MR. SMITH: Did you --

MR. JASINSKI: The differences. But we don't know --

MR. SMITH: Did --

MR. JASINSKI: We don't know how many of those exist at each efficiency level is what I'm explaining.

MR. SMITH: Oh, I got it.

MR. JASINSKI: Because they're weighted at each efficiency level --

MR. SMITH: I got it.

MR. JASINSKI: -- by the number of model, number of sale at that efficiency level. So if we can't determine how many were sold --

MR. SMITH: What I don't understand, though Sam.

MR. JASINSKI: Yeah?

MR. SMITH: As you go from EL-0 to EL-whatever, an EL-7, all right? What data do you have that suggest to you that the costs don't change as you move from one to the other? I don't get that.

MS. ARMSTRONG: So --

MS. IYAMA: I think it's more that we don't have data that could help us.

MR. WHITWELL: So --

MR. SMITH: Well, I --

MR. WHITWELL: So --

MR. SMITH: Wait, whoa, whoa, whoa, whoa, whoa. You went out and you tore down, you tore down fans of these three types. You interviewed manufacturers who make these three types.

MS. ARMSTRONG: Uh-huh.

MR. SMITH: You can't --

MS. ARMSTRONG: But, so --

MR. SMITH: So we must appreciate that there's a different cost.

MR. JASINSKI: So what was done is --

MS. ARMSTRONG: I --

MR. JASINSKI: in the first, in the first NODA, we made assumptions about number of models and sales. But then we were given a database that had exact sales. So if you were --

MR. SMITH: I'm not talking about savings, I'm talking about cost.

MR. JASINSKI: I know. But we were asked to do our analysis to model that database.

MR. WHITWELL: Right, yeah.

MR. JASINSKI: This is what comes out when we model that database.

MR. SMITH: So you didn't integrate information that you had from other activities? You just, this is just from the database? And since the database doesn't have this information, you ignored other information you had from other activities? They didn't integrate --

MR. JASINSKI: I --

MR. SMITH: -- your interviews with the databases?

MS. ARMSTRONG: Yes, we did. I mean, what Sam is trying to say is, I think there's two things going on. One is the database doesn't show that these products are being sold. That's one thing, right? You gave us a database of sales and there are individual points in there and we modeled each of the individual points in terms of costs. We did integrate feedback we've gotten, but what you're seeing here is when you analyze your database and the attributes of your database, this is kind of what we get. So if we think there are gaps in terms of information of products that exist on the market that aren't being reflected here, that's because that they're not in the database, as far as we could distinguish. Happy to have that conversation, a non-issue. I think one of the questions that was thrown out, I mean, Bob and otherwise, I get what Dan said, he clearly said the MPC would be different for a certain type of fan because it has a completely different design. I mean, just because something has a completely different design doesn't necessarily necessitate that it costs more from a materials --

MR. WHITWELL: Okay, but --

MS. ARMSTRONG: -- purely standpoint. We haven't gotten to MSP, and I get that we might have to change capital, I get that you might have to change other things. That's going to be a reflected later, but you could also come up with, come to a situation where to make a more efficient fan, purely materials based, if, if a delta is close to the top.

MR. WHITWELL: So I would disagree --

MR. SMITH: It could be.

MR. WHITWELL: -- because, I mean, the panel fan, let's use that because it's a simple -- it could a, the EL-0 could be a two bladed model, right? As you move across to higher efficiencies, you're going to add more blades. You're going to add material because you're going to have a denser fan --

MS. ARMSTRONG: Yes.

MR. WHITWELL: -- as you look at it. And then on the far right, you might have something that's made out of a composite material that's got, you know, it's a lot more expensive than what you're looking at, at the --

MS. ARMSTRONG: So I think --

MR. WHITWELL: -- at the left.

MS. ARMSTRONG: -- this is exactly the example what we're looking for, right? If you would each --

MR. WHITWELL: Okay, so --

MS. ARMSTRONG: -- march down that line, you would do X, Y, and Z changes that are -- I think what we're trying to tell you is that's not discernible from the database.

MR. WHITWELL: Okay, so what would be helpful --

MS. ARMSTRONG: The --

MR. WHITWELL: -- for us, for me and I think others that don't have access or haven't seen the database is, which of these do you have examples for and which one are not flat?

MS. ARMSTRONG: Okay.

MR. SMITH: Or else --

MR. WHITWELL: Or else --

MR. SMITH: -- are they --

MR. WHITWELL: -- not even, just assume it's flat, right? That would be helpful.

MS. ARMSTRONG: We don't have to walk through it, I don’t think that -- okay, so go --

MR. WOLF: The next question.

MS. ARMSTRONG: You may.

MR. WOLF: So some other questions, have you said motors are not (indiscernible)?

MR. JASINSKI: No.

MR. WOLF: But we do agree that this much are going to be, the ruling, the rulemaking is going to be wire to air, correct?

MR. JASINSKI: Yes.

MS. ARMSTRONG: It will, it will be.

MR. WOLF: So a key part of the efficiency of the fan is going to be the motor and maybe the drive? And one way to improve the efficiency of the fan is to maybe go to a more expensive motor. But that's not a conflict.

MR. JASINSKI: Or is --

MR. WOLF: The analysis either done and should it be, I guess, or?

MR. JASINSKI: No, it's not accounted for in the analysis taken.

MR. WOLF: But it probably should be, right? If that what the rulemaking's --

MS. ARMSTRONG: It's all accounted for.

MR. WAGNER: Or --

MR. WOLF: I'm sorry?

MR. WAGNER: And Mike, you raise a good point. Variable speed is also an important consideration.

MR. WOLF: Right.

MR. WAGNER: Part load operation versus full load.

MR. WOLF: Yeah.

MS. ARMSTRONG: So we can do that, right? I mean, we can definitely, I mean, sort of analysis the cumulative effect of optimizing the fan, the motor, and the drive system on the wire to air efficiency. But that would mean that those levels that you might be able to obtain by optimizing that a given fan manufacturer would then potentially have to, does that make sense?

MR. HAUER: It's Armin Hauer speaking.

MS. ARMSTRONG: You should want to.

MR. HAUER: Yeah, we, that is, we do electric fans and motors and our experience is that if you make a better fan, you can save on the motor. So that's the, we try to optimize our materials.

MR. WOLF: So you're saying --

MS. ARMSTRONG: So you're saying find a level of (indiscernible).

MR. HAUER: It's ending cheaper, actually.

MR. PERSFUL: Trinity from Twin City Fan. So what you're looking for is for us to take that, those functions, compile our own data, and if it's different or whatever we consider to be specific, give you that feedback and then we can move on? So our task is, if we so choose it, is it takes that formula, apply our stuff to it. If we get something vastly different, let you know?

MR. JASINSKI: Yeah.

MR. PERSFUL: I mean, it is, would end --

MR. JASINSKI: Yeah. It's twofold. It's data to feed into the methodology that we're explaining, and it's feedback that if there's a methodology that we're using that you don't agree with, let us know what you disagree with and an alternative.

MR. STARR: So this is Louis with NEEA, I was kind of wondering would it be -- the information you need is, at best, done by a manufacturer, by manufacturer basis? Or --

MR. JASINSKI: That's it.

MR. STARR: -- is there enough information that it could be probably developed into a survey tool and conduct information by filling in the requests for information through a trade circulation.

MS. ARMSTRONG: I mean, that's totally on a manufacturer by manufacturer basis.

MR. STARR: Okay.

MS. ARMSTRONG: On our experience previously.

MR. STARR: Okay.

MR. JASINSKI: Paul?

MR. LIN: Paul Lin from Regal Beloit, so one of the things that was mentioned was the variable speed. Based on the current formulas that you have today, it doesn't take into account any variable speed component, so we would have to add that into the formula in order to bring that variable speed component into it.

MR. JASINSKI: Okay.

MR. LIN: Yeah.

MR. JASINSKI: Thanks Paul.

(Off the record discussion.)

MR. JASINSKI: So next we determine a manufacturer markup. This supplies the manufacturer production cost to arrive at a manufacturer selling price in the base case. The manufacturer markup up that we used for the NODA was 1.45. And then that, that's indicative of a typical, we're making a typical engineering analysis. But as I mentioned earlier, we also wanted to incorporate conversion costs. The way we did that was we calculated the total conversion costs and each efficiency level for the industry. And we derived markups as that efficiency levels that would allow for the manufacturer to recover those conversion costs. And I'll explain those shortly.

So the outputs of the engineering, as I touched on, that were passed on to, to the downstream analysis where the manufacturer production costs by equipment group and efficiency level. The manufacturer markup that I just identified. And then total, the total industry conversion costs by equipment group and efficiency level. The conversion cost recover markup that I mentioned that was calculated based on those total industry conversion costs, was calculated as part of the LCC and had a very similar approach that was used in pumps. For those that aren't familiar with that, we will describe it here.

So redesign costs. DOE, as I mentioned earlier, DOE recognizes that fan efficiency is improved primarily or predominantly through aerodynamic redesign, aerodynamic redesign costs do not necessarily impact manufacturer production costs, but require investment in R&D, testing, and other conversion costs. We develop the cost recovery, the conversion cost recovery markup methodology to account for aerodynamic redesigns in the cost efficiency relationships, using the analysis. And the cost recovery markup is based on the total cost of aerodynamic redesigns to the industry required for me to give a level applied to the NPC to calculate manufacturer selling price that would enable the manufacturers to recover those redesign costs.

MR. ERNST: So what value, what value did you use?

MR. JASINSKI: We'll get into that. But there is also a spreadsheet, I believe it's incorporated in the engineering spreadsheet in the new, most recent package that shows the total conversion costs for the industry by efficiency level on the website.

MR. WHITWELL: So just a comment on this, so Bob Whitwell from Carrier. So redesign costs for us are going to tend, they could vary significantly depending on what the use is. A supply air fan that's used in a, for cooling and heating is going to have a very high redesign cost, because we've got to completely re-qualify the air conditioning and the heating side. Prop fan, a conductor fan, could have a different redesign cost but still be significant, because we have to re-qualify the air conditioning side. An exhaust fan, significant but less than those. So somehow I guess we'd have to, I don't know --

MR. JASINSKI: The --

MR. WHITWELL: -- how you'd account for that.

MR. JASINSKI: The best way to do it is describe the scenario that you're talking about, you know? Pick the different cases for your particular company or industry, and describe that scenario in the terms that we're using here. So, you now, and then we will try to figure out the best way to account for it in the analysis, so. Talk about, well, here's the list of things that the, that I would, the factors that I would say are most important when trying to describe or characterize the scenarios that you are alluding to. So for those of you that are a little more mathematically minded, the slide that I just presented, I put at the top an equation form, the manufactured selling price for this analysis is that manufacturer markup times the cost, the conversion cost recovery markup, times the manufacturer production costs. So DOE estimated product and capital conversion cost to determine a markup that would enable manufacturers to recover these costs. On the left, you'll see a list of the product conversion costs. They're modeled the same, modeled -- or, I'm sorry. Some of the assumptions and the actual factors are included. Their model is the same for each subgroup. We have 12 months total redesign time. Six months testing time. Adding costs for non-DOE certifications and marketing, and we calculate the labor rates to derive costs for that testing time and redesign time from the Bureau of Labor and Statistics. And I believe a lot of that is also included in that conversion costs tab in the published spreadsheet.

On the right, we have a list of the capital conversion costs. These are modeled as different for each subgroup, because each subgroup is assumed to have different impacts on the production line, depending on whether you're trying to produce more airfoil blades or more forward curved blades, those capital conversion costs would be different. And as I mentioned, it assumes investments in fabrication and tooling. We have a footnote here that product and capital conversion costs were modeled as the same, regardless of the size of the fan. So --

MR. SMILEY: Bill Smiley, Trane. Just a quick question. These costs are associated with, apparently you already knowing what you want in a design change you want to make, are there any costs associated with the R&D required five years earlier than this?

MR. JASINSKI: Yes. If you see on the left, in the product conversion costs, there's 12 months total redesign time, that includes --

MR. SMILEY: That's --

MR. JASINSKI: -- R&D.

MR. SMILEY: -- a redesign of the product, making drawings, building samples, just these. I'm talking about the time required to come up with what that design change ought to be.

MS. ARMSTRONG: In the MIA.

MR. JASINSKI: I --

MR. SMILEY: Is that --

MR. JASINSKI: Well, this typically, this is typically in the MIA, but we're including it in the engineering analysis. What I would say is, that redesign time is supposed to include things like the R&D. So if you think it should be longer than 12 months --

MR. SMILEY: Okay.

MR. JASINSKI: We're talking about 12 months multiplied times the labor rate. We're not talking about, we're not talking about, we're talking about 12 months of working time. It might happen over the course of five years.

MR. SMILEY: So in other words, the R&D work we associate with trying to out how to design a more efficient fan should be included in the -- in the modeling that you're doing.

MS. ARMSTRONG: To the extent that manufactures believe they're going to full pass that on.

MR. SMILEY: Well, if you want to stay in business, you have to pass it on somehow, yes.

MS. ARMSTRONG: I'm just saying, I mean, you know. We've gotten feedback depending on the industry, but yes.

MR. SMILEY: Okay.

MS. ARMSTRONG: Yeah.

MR. SMILEY: Just a question, thanks.

MR. FLY: What, it's Mark Fly with AAON. What kind of timeframe are you trying to distribute this recovery?

MR. JASINSKI: So in the analysis, it's recovered over the analysis period, which was 30 years.

MS. ARMSTRONG: And you can change that. We ran different scenarios and pumps for a variety of reasons.

MR. FLY: Wow, I wish I could have people to invest in equipment just like that.

MR. JASINSKI: I think I saw a hand over here?

MR. DYGERT: Thanks, Ryan Dygert, Carrier. Just a clarification question on establishing conversion costs, problems with (indiscernible) aside, does that mean if I need to go out and buy a 10 inch mold for an injection molded fan, you would put it in the same cost as to a mold for a 16 inch diameter fan?

MR. JASINSKI: That is --

MS. ARMSTRONG: Not necessarily.

MR. JASINSKI: Not, no, not necessarily.

MR. DYGERT: Okay.

MR. JASINSKI: No.

MR. DYGERT: It's not clear the way it was written on the opinion.

MS. ARMSTRONG: Yeah.

MR. JASINSKI: Yeah, understood.

MR. ROY: Question on the -- Aniruddh Roy, Goodman. Question on the manufacturers (indiscernible).

MR. JASINSKI: That's mostly from things like SEC filings, you know, revenue versus possible goods sold for the industry. Things like that.

MR. WHITWELL: Component suppliers?

MR. JASINSKI: What's that?

MR. WHITWELL: For fan component suppliers.

MR. JASINSKI: I'm not sure I understand your question.

MR. WHITWELL: Well, I mean, we have a different number being used for HVAC, and it's not, you know, I guess we're in the wrong business, that's all I can say.

MR. SMILEY: It's make your own fans?

MR. WHITWELL: Yeah. Well, we do.

MR. SMILEY: I know. Because we know it's not working out for us.

MR. JASINSKI: See and I --

MR. WAGNER: Greg, Greg. The important point here, I think, might be that downstream, if you change a fan in a HVAC equipment manufacturers, they're going to have to re-qualify for safety and efficiency and performance, so there is subsequent downstream testing that's not included in this particular slide.

MR. JASINSKI: Well, it's a -- we have costs for non-DOE certification and marketing, so we have, we have that factored in. Whether or not the assumed value -- we would love to get feedback on what that assumed, what that value should be. How much does it cost?

MR. WHITWELL: Yeah, so Sam, I'm sure it's a lot more --

MR. WAGNER: Well, this is Greg. Just let me, I'm going to say that redesign time that actually and testing time, I don't know whether it's quite right or not, but certainly that would be something that close to what it would be for fans. But there's subsequent design and testing and validation work that needs to take place, right? Design over and above what you don't see on that time table. Certainly, given the other things that are going on in the industry with efficiency changes for furnaces, air conditioners, refrigerant changes, et cetera, there's a lot of things going on. So that empty time could be quite expensive beyond just the fan development and testing.

MR. JASINSKI: I'm going to get a little, into a little bit more detail on --

MS. ARMSTRONG: You know, I think I'm going to cut you off.

MR. JASINSKI: Okay. But --

MS. ARMSTRONG: And sorry, it's 12:15. We only have a couple of hours. I do want to break for lunch. What we're going to try to do is we're get -- I'm going to stop you here and I do want to come back and get to the LCC parts. The reason for that is because the next couple of slides Sam's going to show are twofold. A couple of things is in house numbers in terms of what we estimated conversion costs and how that works. Obviously we want your feedback on it. But it's typically something you're going to volunteer anyway. The other is, you know, how this all wrapped up into getting SP values. Also, something we want your feedback on, but like I said, I think it's something you're going to have to take with you and look at and understand. And I want, today, to be able to at least introduce the LCC and so how we get to some of the modeling type issues, the choice model in terms of how we're making these designs. So at least when you take away this package and you look at the potential spreadsheets in the interim in between, you will have some context for that.

MR. WHITWELL: Okay, Bob Whitwell. And just one more comment on this, and then I'll shut up on it. But so the comment made about the fan design and then the equipment design, so those are sequential, right? And then the other thing, question I have and you don’t need to answer this, but I mean, you're showing 12 months total design time and six months total testing time. Depending on, I don't know how many engineers you assume that are doing the fan redesign or how much testing is, you know, how much, how many samples are being tested and stuff like that. That could play a significant role in (indiscernible).

MR. JASINSKI: Maybe --

MR. WHITWELL: Is that laid out in --

MR. JASINSKI: Maybe man hours is a better --

MR. WHITWELL: So these are man hours? One man year for the design? Six man months for the adjustment?

MR. JASINSKI: Yes.

MR. WHITWELL: Okay. Thank you.

MR. JASINSKI: Lunchtime?

MS. ARMSTRONG: All right, it's lunchtime. How quickly could we get back here?

MR. SMILEY: 1:15.

(Whereupon, a brief recess was taken.)

MS. ARMSTRONG: All right, so we're going to start back. So we're going to pick up on the LCC and walk through that now.

MS. IYAMA: Okay, so the LCC, the Lifecycle Cost Calculation is basically calculating, or adding the insulation costs, or the first cost, and the operating costs into what is called a Lifecycle Cost. And so it uses, an input, some of the data that Sam presented. And one of the key items to understand is the approach that we took when analysis the AMCA database, in terms of how do we determine if a particular fan will be redesigned when a standard is, comes into place. Or is it going to be replaced by an existing compliant fan. And so what we did, and we've already discussed, you know, alternatives to this approach, but here I'm just going to describe what is actually in the NODA, is that we, so we have this database of 70,000 fan selection. We pick one and we evaluate whether it meets a particular efficiency level. If it does, then nothing happens. There's no impact to the customer, it just keeps the same fan as the original fan that was selected. And so that's what is going on in the left part of that graph.

But if a particular fan selection doesn't meet a considered efficiency standard, then we consider two cases. In the first situation, we looked at the other fans that were in the database that have the same fan equipment class, or fan category, that have a design point within 20 percent flow and pressure, and that have the same diameter. And so these were, sort of, our filters to select an appropriate substitute, and of course it had to meet the standard.

And so with this process we were able to sort of identify a list of existing compliant fan substitutes that could eventually replace a particular fan selection that didn't meet a considered standard. And so that's the reselection scenario. And I have a list of, sort of, all the input parameters that can change that scenario. For example, we could tighten or broaden the window around flow and pressure. We could say we know, we don't want it to be in the same fan equipment class. We want to try staying within the same subcategory and limit the reselection to a fan that is of the same fan subcategory. So that's the reselection scenario. And then we also considered the case where, you know, we couldn't find any existing compliant fan substitute that meet these, that met these criteria. And in this case we assumed that the non-compliant fan would be replaced by a redesigned fan. That fan would have a price that is calculated using the inputs that Sam presented from the engineering analysis.

MR. ERNST: Question? How, unless you were up at EL-06, how could you not find those replacement fans?

MS. IYAMA: Because we were limited in the data that was available and in the assumptions that we could make. So the, each fan has a pretty broad operating region. We didn't have that information, we just had for each model a single selection point. So that's where, you know, that window of 20 percent could be broadened and say hey, you know, that fan? You assume that it can only operate at this particular selection point, and then you kind of -- and we use this 20 percent window to say, well if it can operate here, it can probably also operate within that region.

MR. JASINSKI: Sanaee, I just want to add that it's not that we only had one operating point per model. We only had one operating point per sale. So if a model was, if a model had a lot of sales, we have very operating point at which that model was sold. So we might have a partial --

MS. IYAMA: Right.

MR. JASINSKI: -- map of that fan's performance.

MS. IYAMA: But not the complete --

MR. JASINSKI: But it, but not, not necessarily complete and I'm sure there probably are examples of fan models where there was, it was only sold that one operating point. It's possible, I don't know --

UNIDENTIFIED MALE: Many.

MR. JASINSKI: -- how probable that is.

UNIDENTIFIED MALE: Many. Often.

MS. IYAMA: So the next line, I'm going to go through them pretty quickly, in the interest of time. But this line is just to say, well this is how we would calculate the MSP of a fan in the database. So we just take, like, someone went over this already, we'd just take the manufacturing production cost, multiple it by the markup of 1.45, and in the case where a fan is replaced by an existing fan, we use the same equation. There is no redesign cost, because that fan is already on the market. In the case where we have a fan that's replaced by a fan that's being redesigned, we need to incorporate those increasing costs. So the MSP of that fan, that new redesigned fan, is going to be calculated using the equation that the, the MPC equation that Sam presented with the multiplier of value that corresponds to the efficiency level that's being analyzed.

So let's say, you know, I pick a fan selection, this fan's selection is at EL-01, so I was using the equation with the multiplier at EL-01 to calculate the MPC of that fan. That fan is now redesigned to meet, let's say, EL-03. I'm going to calculate the MPC of that fan using the multiplier at EL-03. So it's pretty straightforward. The only thing that's a little different from the traditional way of calculating costs is that we're adding those conversion costs, in the form of a conversion cost markup.

Where is that? Yeah, it didn't go through. Yeah. So for the, yeah. So you'll have it in the slide, the equation that doesn't come up on here.

MR. WAGNER: If we could go back -- sorry, Greg. Going back to slide five, it'd be 30 years to amortize that cost markup of the conversion costs?

MS. IYAMA: Yeah.

MR. WAGNER: Does that mean that DOE won't have any regular for the next 30 years to change this or any other standard?

MS. IYAMA: So I think --

MS. ARMSTRONG: Mike, you need to answer that one.

MR. WOLF: Nice try.

MS. ARMSTRONG: I think -- Mike could guess to answer that one.

MR. SMITH: Well so that conversion cost should really be recovered during the cycle, until the next, until the next redesign then? Until the next --

MS. ARMSTRONG: So I mean, you guys are welcome to --

MR. WAGNER: I don't, I don't mean --

MS. ARMSTRONG: -- say what a reasonable time period --

MS. IYAMA: So I think --

MS. ARMSTRONG: -- of recovery would be.

MS. IYAMA: I'm trying to get through the slides. I have a summary slide at the end of all these individual inputs that kind of summarize our assumptions.

MR. SMITH: Okay, may I ask a, just a point of a point of clarification. If the fan, a non-compliant selection is replaced by a compliant selection that's in the database.

MS. IYAMA: Uh-huh.

MR. SMITH: In that scenario, do you assume that there's no redesign. Is the compliant and selection that you picked from the database from the same manufacturer?

MS. IYAMA: No, but it could also be --

MR. SMITH: Okay, so that's also a false

assumption because the manufacturer who lost that sale will redesign because he doesn't want to lose the sale to his competitor perpetually. So the fact that there is another fan on the market which would satisfy the need is no reason to say that there isn't going to conversion costs. There will be conversion costs.

MR. JASINSKI: So, I, as I mentioned earlier, we have a list of what we call limitations. Basically limitations that we've identified, and that's one of them on the list. We understand that with this methodology there's certain limitations to that impact. Ideally, this is going to drive a count of the number of redesigns and reselections for the analysis, and the redesign count is obviously used to calculate the total industry conversion costs.

MR. SMITH: But it's --

MR. JASINSKI: So we have a list of limitations and basically say we understand that for exactly what you've said. Just because, just because there is another fan that is compliant at the operating point and it's a reselection does not necessarily mean that there are no redesign costs. Because a manufacturer, as you've described, loses that sale, they might decide to redesign in order to have that sale, so.

MR. SMITH: Not might, is my point.

MR. JASINSKI: Okay, so, well, what I'm saying is, we have a list of those limitations, and those are things that we would like to get feedback on.

MS. ARMSTRONG: You got it.

MR. JASINSKI: So you're saying that --

MR. SMITH: You can --

MS. ARMSTRONG: You got it. We can implement that.

MR. SMITH: -- you can change it?

MS. ARMSTRONG: Yeah.

MR. SMITH: With this assumption?

MR. JASINSKI: Yeah.

MS. IYAMA: Yeah.

MR. SMITH: Good.

MS. IYAMA: So an easy way to implement it would just be to add an additional filter when, you know, looking for a substitute, it would have to be from the same manufacturer.

MR. FLY: And, Mark Fly with AAON, for us packaged unit manufacturers, any kind of supply fan that's really a -- there will be a conversion cost. If we cannot change the fan, at all, any kind of airflow change that's coming off that fan will change the, we have to re-go through heater qualifications, which is a six month test. Run time.

MR. WHITWELL: Per unit?

MR. FLY: Per unit.

MS. ARMSTRONG: (Indiscernible).

MS. IYAMA: So I'm going to jump onto the energy use and to the calculation of the operating costs. And here's it's just the equation for calculating what we call the unit energy consumption in kilowatts per year of a given fan in the database. So here one of the assumptions that we made and that could be changed is that we assumed the fan would operate at its design point. And I think yesterday I heard some, like V, like VAV fans operate at 60 or 80 percent of that design point. So this kind of feedback, you know, saying well you assumed it's operating at the design point. In reality, it's most likely going to be operating at X or Y. That would be useful. Although, in the database, we don't, we only have the performance data for that particular design point. So there's limitation in what we can actually analyze.

MR. Smiley: So, real quick question. This is Bill Smiley. Where's the time on this equation that says overall average per year?

MS. IYAMA: I --

MR. SMILEY: Because you need some type of hours --

MS. IYAMA: Yeah, hours are missing.

MR. SMILEY: -- of operation per year.

MS. IYAMA: You're right. It, it's multiplied by hours.

MR. SMILEY: Well, I assume that's in the spreadsheet?

MS. IYAMA: Yes, it is.

MR. SMILEY: But left off this equation?

MS. IYAMA: Correct.

MR. SMILEY: Which makes this equation incorrect?

MS. IYAMA: Yeah.

MR. STARR: So, this is Louis with NEEA. So if you were on, if you use something, I assume it would be less than the design point is what you're getting at. Because it, it, so you look in your database and you get a flow on the head, and then the assumption is, is that --

MS. IYAMA: This is --

MR. STARR: Chances are, it's going to be less than even? Forget about the VAV aspect of it. If you're putting it into a system, the chances that that meets right at the design point probably aren't good. And the chances are, the real design point, most likely, is less than that or you wouldn't be able to meet your design requirements. So I kind of wonder, I mean, it essentially predicts less energy. We'll do it that way, as opposed to using jus the design point that you have. I mean, is that kind of the summation of?

MS. IYAMA: It's so it's just to point out that the operating point in the field, in the lifecycle cost calculation, was assumed to be equal to the design point.

MR. STARR: Okay.

MS. IYAMA: Specified by the purchaser. And so, for the fan performance data, that came directly from the AMCA database, so each fan selection was associated to flow pressure and efficiency value for the fan. And then we added additional assumptions to characterize the motor and whether or not, if the fan was sold in a belt driven configuration, then we accounted for the belt losses and these are exactly the same assumption and presented when talking about the metrics. I'm going to go pretty quickly over these.

UNIDENTIFIED MALE: Same thing.

MR. SMILEY: I have a question or maybe a suggestion. Bill Smiley, Trane. We have a multiplier of 1.2 that you multiply it by the fan's brake horsepower, the size of the motor. So the motor name plate needs to be that or larger. In a lot of our equipment, we don't use 1.2, we may have a specific design motor, or we may select another motor close to what the fan brake horsepower is and not oversight. And you can get away with that a lot of the fact that they're over-tight motors because they're pretty --

MS. IYAMA: So input could be replaced by a distribution.

MR. SMILEY: Yeah, it's just --

MS. IYAMA: If you want it to be more --

MR. SMILEY: -- point out that we might need to --

MS. IYAMA: -- representative.

MR. SMILEY: -- evaluate that more.

MS. IYAMA: And then, another input that you can see was missing from the equation are operating hours per year. We derived different operating hours depending on the sector and the application. They're presented in more detail, details in the LCC spreadsheet. And here I just have sort of an example of our assumptions in terms of how fans are distributed across sectors.

MS. PETRILLO-GROH: May I?

MS. IYAMA: Yes?

MS. PETRILLO-GROH: Laura Petrillo-Groh, AHRI. Could you just give a range of the operating hours that are used?

MS. IYAMA: I think there's a couple sides that are in the --

UNIDENTIFIED MALE: Slides coming up.

MS. PETRILLO-GROH: Thank you.

MS. IYAMA: And for example, in order to characterize whether a fan would be used more likely in the commercial, industrial sector, that depends on whether it's a small fan or a larger fan. So if you're a small fan you have a higher likelihood to be used in the commercial sector. And the higher you go in size, the example, if you're, you know, a 100 horsepower, there is 61 percent change that you'd be used in the industrial sector.

MR. STARR: Yeah, so it's Louis, just on the last one, did you include the efficiency of the motor in there somewhere in sizing up the stuff? So the 1.2 was for?

MS. IYAMA: Size of the motor.

MR. STARR: Well, it's not 100 percent efficient, right? So once you know what your brake horsepower power and size are, the balance, then you need an efficiency for the motor too, because it --

MS. IYAMA: Yeah. So the part load calculation, part load, calculation of the part load losses of the motor was done in the same way that you would do it for the metrics, that it didn't really go through that in the details, but.

MR. STARR: So you figured out the flow and head and came up with what the horsepower requirement was?

MS. IYAMA: Yes.

MR. STARR: You divided by 1.2 and divided by the motor to choose what motor size that you would need? There actually is one other step you would need. You need to see if that motor's actually available. You could come up with 3.4, but they don't make a 3.4 and have it be --

MS. IYAMA: Well, then we go to the --

MR. STARR: Motor cadence?

MS. IYAMA: To the --

MR. STARR: Okay.

MS. IYAMA: -- closest motor available.

MR. STARR: All right.

MS. IYAMA: That's above that number.

MR. BOTELER: This is Rob. The other issue that you have is you're looking at the data that we gave you for pumps, which was a closed motor, there's open motors. There's no air over motor data.

UNIDENTIFIED MALE: No.

MR. BOTELER: We told you the other day, air overs are significantly lower efficiency than what you would have in a pump data based on using the full closed ones.

MR. STARR: That describe about energy use a little more, right?

MR. BOTELER: Right.

MR. STARR: Yeah.

MR. BOTELER: Yeah.

MS. IYAMA: So this is just, this is some of the, so all of the tables, in detail, are in, detailed in the LCC spreadsheet. This is just an example of sort of how we express the reliability and operating hours for the commercial sector. So we identified two main applications in the commercial sector. Each equipment class has a different distribution and across those two application, at the bottom of the table you have the average and the operating hours for each of these application. But it's an average value. And what is actually using the calculation is the distribution that you have on the graph below. Where, you know, the operating hours could be samples anywhere between basically zero and 8760 per year.

MR. BOTELER: Well that min/mix is hours?

MS. IYAMA: Yes.

MR. BOTELER: Wow.

MR. ERNST: Now you have, I mean, like for instance, in the, then, in number eight --

MS. IYAMA: Yeah.

MR. ERNST: -- you have a huge usage about 7500 hours. What type of industry is that?

MS. IYAMA: So these operating hours were -- wondering if I have the source cited. So we used Energy Plus data for the, for these operating hours.

MR. ERNST: But which air conditioning has to be a big chunk somewhere. I mean, it's nowhere near that right now.

MR. SMILEY: Hell, that's 22 hours a day, 7 days a week.

MR. ERNST: I mean, air quality is 5000, well 4000 hours. Maybe 5000 is better.

MR. PERSFUL: This is Trinity. That's most industrial applications.

MR. SMILEY: Right.

MR. ERNST: So again, I guess if this is all industrial, you're not going to --

MS. IYAMA: These are the commercial center --

MR. ERNST: It doesn't seem right.

MS. IYAMA: And then --

MR. SMILEY: Bill Smiley with Trane. I think what this points out is for different types of equipment, there may be different operating hours that should be used in any analysis like this. And it's probably, I would assume, up to us to come forward with what we believe the operating hours per year for the type of equipment that we're talking about.

MS. IYAMA: So here, the way that it's constructed, each sector and application associated to a number of operating hours or statistical distribution of operating hours. And then each equipment class is associated to a distribution of application.

MR. SMILEY: Right.

MS. IYAMA: So if you're a centrifugal house, you're going to be, you know, in the commercial sector and you're only going to be using clean air ventilation. If you think there is other, there are other applications that should be considered for that sector, and that equipment class.

MR. SMILEY: Well, I'm suggesting that there may be other groups. There are other ways of grouping this --

MS. IYAMA: Right.

MR. SMILEY: -- other than fan design specific type.

MS. IYAMA: Okay. So I'm going to --

MR. ERNST: One more.

MR. SMILEY: Hold, hold, hold.

MR. ERNST: When you said on that slide, it looks like you had centrifugal house with a zero exhaust fans?

MS. IYAMA: Correct.

MR. ERNST: I mean, there's a pretty good percentage where those types of fans are exhaust fans.

COURT REPORTER: Please don't tap the table.

MS. IYAMA: So I think I, you know, these are all good feedback for us. I'm trying to go through all the slides and then if you want to either come back with data on this or your best estimates or, you know, a suggestion on what those numbers should be, that would be really helpful. Here's it's just the result of the calculation, using all those assumptions, how the kilowatt per year would look like for each of the equipment classes at each of the considered efficiency levels. And then we get into the other inputs for the Lifecycle Cost Calculation, one of them is lifetime. So we heard from the comments that we received that these may be, you know, a little too high. We haven't found data that could support changing of those numbers. If you have information that could help us it'd be very useful. The approach here was to calculate a mechanical length time, so the number of operating hours that the fan is able to provide before, you know, before its, before it reach its end of life. And then we would divide that by the annual operating hours to get the lifetime of the fans.

MR. SMITH: Sanaee, I just have one quick question. If you could go back a couple of slides, and then I promise not to dwell on it?

MS. IYAMA: Which one?

MR. SMITH: Next one back. There. Well that's okay, that's good.

MS. IYAMA: This one?

MR. SMITH: The chart at the bottom?

MS. IYAMA: Yeah?

MR. SMITH: Okay, so for example you've got a very large bar for commercial and seven and eight, nominally 7000 hours of operation a year. And that is very high, just, you know, conceptually. But then does that tie to the next slide? Is that chart there consistent with what the figures on the next slide?

MS. IYAMA: The next slide is for the industrial sector.

MR. SMITH: Okay. Do the industrial numbers tie to this slide?

MS. IYAMA: No, we have different distribution of hours for the industrial sector. And these are in the LCC spreadsheet. I just didn't put all the tables on the slides.

MR. SMITH: Right, but the chart, go back. You have green bars for industrial.

MS. IYAMA: No, it's --

MR. SMITH: Oh.

MS. IYAMA: It's commercial and ventilation --

MR. SMITH: I stand corrected.

MS. IYAMA: -- and commercial exhaust.

MR. SMITH: Okay, now I understand.

MS. IYAMA: Yeah.

MR. SMITH: My mistake.

MS. IYAMA: And again, it's a lot of data, so, you know, it's all in the LCC spreadsheet. I think there's a sheet called application and sectors or something like that, with all the tables in there.

MR. STARR: This is Louis, I would suggest in your operation hours you can go and use the 90.1s and get the schedules off there and that would give you a snapshot of the operating hours.

MS. IYAMA: So right now we use, we use Energy Plus building simulation data.

MR. STARR: Oh, that's --

MS. IYAMA: Yeah, that's where it from.

MR. STARR: From the 90.1 form?

MS. IYAMA: I'm trying to remember what --

MR. STARR: Okay.

MS. IYAMA: -- but it's, it's described in the LCC spreadsheet, and so.

MR. STARR: Okay.

MS. IYAMA: The exact source.

MR. SMITH: Now do we need to prepare sort of like a formal comment for this? Because what you did was not right. So the question is, how do we get it to be right?

MS. ARMSTRONG: What do you want to change?

MS. IYAMA: Well, in terms of the approach or the --

MR. SMITH: Huh?

MS. IYAMA: -- implementation?

MS. ARMSTRONG: Tell us what you want to change.

MR. SMITH: Well, I think Louis had the right idea. 90.1 does a really good distribution of commercial operating hours, and none of them --

MS. ARMSTRONG: Take it under consideration.

MR. SMITH: -- are close to 7000.

MS. ARMSTRONG: No problem.

MR. SMITH: Okay.

MS. IYAMA: So here it's just a summary of all the input that impact the results of the LCC. So reselection criteria, we talked about it. We could add, it has to be from the same manufacturer. So this is just to help you kind of go through and, you know, if you have a different idea of how this should be done or what we should use, this is what you'd look at and want to tell us how to change it. and we could change it.

MR. WAGNER: This is Greg. I'd like to understand better where that 1.2 came from, under the default motor and transmission.

MS. IYAMA: It's mainly based on literature review of motor sizing practices and --

UNIDENTIFIED MALE: Well, I --

MS. IYAMA: -- it may not be representative of each way that people do it.

MR. STARR: So --

MS. IYAMA: Yes.

MR. STARR: -- this is Louis Starr. That, I mean you think about it, you'd want to change that factor right, for oversizing. In case it's wrong. And then you'd want a

10 percent service factor on your motor, so 20 percent, that's --

MR. BURDICK: Yeah, it's Larry with SPX, and so typically in our industry the way motors are sized to use a service factor motor of 1.5, service factor motor. And that you would, you know, basically from the design point, you know, right up to the name plate. You would go into the service factor during cold periods or possibly go into the service factor in other periods, but when you're operating on a VFD fans slow down and so you don't infringe on the motor maintenance or that type of thing. We would like to see consideration of that, possibly say either actual expelled motor, actual implied motor horsepower, or 1.2 factor.

MS. IYAMA: All right.

MR. ERNST: Another, where does the variable speed come into these estimates?

MS. IYAMA: So in this version, we only looked at one operating point, based on the design point.

MR. ERNST: Okay, because that would, on air condition, that would drop your numbers to a third of what you have.

MR. SMITH: Yes.

MR. SMILEY: Do you have a provision built in that would accommodate the VAV for an (indiscernible)? That would do that?

MS. IYAMA: Not right now.

MR. LIN: So, I mean, doesn't that go back to the, what I said earlier, which is that the equations doesn't take into account the part load? So the equation doesn't take into account part load, then she's not going to calculate the usage of a part load.

MR. SMITH: But yeah, she must. Because even though the fan has an efficiency gain at the design point, the fact that it's not operated at the design point means that the savings are diminished. And you can't just walk away and say, well, they're not diminished. Yeah, they're not diminished, because the fan is now operating at some reduced value relative to the --

MR. LIN: So the rating should account for that somehow, but it doesn't.

MR. SMITH: No, it's --

MR. LIN: She can't take account of that without having the rate --

MR. SMITH: The ratings are at the design point, and they do not account for -- but when calculating savings you can't ignore that the fan is being operated at part load.

MS. ARMSTRONG: But there's no, to his point, I mean, there's no push or incentive to operate at, or to max the load more if you don't reflect it in the rating, which is the issue we talked about yesterday with regards to what's going on in HVAC.

MR. SMITH: Well, I just don't --

MS. ARMSTRONG: You can't have it both ways.

MR. SMITH: Look, the calculation of savings needs to be an honest assessment of how much energy will be saved. And if a fan is operating on a variable volume system, the amount of savings associated with changing the efficiency at the design point are diminished. Because the fan doesn't operate at the design point. So you can't just say, well, I can't, I'm going to ignore that. No, well then you get the wrong answer.

MR. LIN: So, would you have --

MR. SMITH: There's a percent --

MR. LIN: -- your fan then take into account and have your fan take into account that it can operate at a lower, lower point and is more efficient than one that would operate only at a single fixed point? Unless --

MR. SMITH: It's not air condition.

MR. BUBLITZ: It's not --

MR. SMITH: It's using less energy.

MR. LIN: Use less energy?

MR. SMITH: Yeah. It's an interesting question and it's one around which there's been a lot of debate. The consensus of the fan manufacturers is that the fans efficiency at its design point should become the regulatory gate, but that said, it doesn't mean that the savings are, should be built on an assumption that the fan runs at the design point all the time.

MS. IYAMA: So, I think what you're saying is, this assumption --

MR. SMITH: Like, the number of hours.

MS. IYAMA: -- here, about you know, the operating point. Instead of using a single point that's the design point, you'd want to see something like a profile?

MR. SMITH: Yes.

MS. IYAMA: Right?

MR. SMILEY: Yeah. Hours and --

MR. SMITH: That's --

MS. IYAMA: So, I think --

MR. LIN: That's --

MS. IYAMA: -- what would be useful then is --

MR. SMITH: Two scenarios.

MS. IYAMA: Uh-huh.

MR. SMITH: There's a constant time scenario.

MS. IYAMA: Right.

MR. SMITH: Which you've mimicked correctly. And there's a variable volume scenario.

MS. IYAMA: Right.

MR. SMITH: Which --

MS. IYAMA: So would it be something like, you know, like half of the time at half of the flow. Third of the time at --

MR. SMITH: We can --

MS. IYAMA: So some --

MR. SMITH: We can give you guidance.

MS. IYAMA: But, and then we could run those.

MR. STARR: I was going to say, in the pumps they had the same debate. They just used 25, 50, 75 equal bends, and they even did a sensitivity analysis on it and surprised, it didn't matter how we changed those bends. SO you're thinking, it's supposed to be 75 percent or 50, it didn't matter because you're using less energy at it.

MS. IYAMA: Right.

MR. STARR: So you could just do an equal way and if that was, you get close enough. The other thing is, you don't --

MR. SMITH: I don't, I think, I remembered with ASRAC a little different ratings.

MR. SMILEY: Yeah.

MR. LIN: But actually, you --

MR. STARR: You could wing it. It won't make any difference. But I mean, you may have to see that with the sensitivity. But anyway, with that, it would get, the other thing you need to know is how many VFBs are on these fans. So I guess they, you must have some sense of that, too. How much these fan selections actually have VFD, multiply it for that portion of the population.

MR. ERNST: Well, going forward, it's a tremendous number.

MR. SMITH: I want to say that the data in the database shows a VFD that was sold by the fan manufacturer, but in most instances, there would just be fans are applied with VFD's purchased by the contractor, not from a fan manufacturer. So the database is not a good indication of how many VFDs are applied to fans. But I think by building, right? Right? They have all these, they have all these building types in the industrial, or different application types. And you've got a weighting for those different application types. It would be appropriate to do the same thing for commercial, and use the operating hours that come out of ASHRAE, 90.1, and some of those building types are going to be a high percentage variable volume. So you can assign a percentage that are variable volume and an average weighted or, you know, use this profile that we're going to give to you. Okay?

MS. IYAMA: All right.

MR. DIKEMAN: So then -- this is Steve Dikeman. Another thing, there's some custom reports that you can do in Energy Plus to report those run times. Energy Plus has some custom outputs. You can go in and get the actual run hours and you can get the loading.

MS. IYAMA: Okay.

MR. DIKEMAN: So that would be yet another way, and then just apply it. You know, I think Trinity's right --

MS. IYAMA: Yeah.

MR. DIKEMAN: -- that he's got a major part of the industrial's going to be 24/7. And then the commercial side. Some distribution of the commercial side would be VAV.

MS. IYAMA: So the commercial sector operating hours that we use are actually from Energy Plus, and we also --

MR. DIKEMAN: But not fully loaded.

MS. IYAMA: -- extracted, we extracted the load profiles as well so we could use those. But my understanding is that there's some disagreement on whether or not we should use these data, so.

MR. DIKEMAN: But even Energy Plus can show you what on the VAV system that you're not doing designed power every operating minute. Here's a scan from the fan on Kramer House (phonetic sp.).

MS. IYAMA: Right.

MR. DIKEMAN: You know, going into 80 percent of feed, I cut my VFD (phonetic sp.) in half.

MS. IYAMA: Right.

MR. STARR: So the 90.1 models gave you those numbers that, you know, that seems, well, okay, no. It should be about four to 5000 hours in a commercial office space, I would think. That's 10 hours a day, five days a week. How many ever weeks.

MS. IYAMA: So the next couple slides are just purely results tables, so I think I'm just going to skip directly through the shipments and national impact analysis. Which, so for shipments, these are units sold by equipment class for the specific scope that was analyzed in the NODA which are fans above one horsepower and below 200 horsepower.

This is from aggregated data for 2012, expanded to the total U.S. market. And it doesn't include all those fans that we didn't consider, like, being useful fans. For example, so that's what we used for our reference here. And then we applied projections to estimate shipments over the entire analysis period of 30 years. Those sort of projections, those projections were used, were based on different indicators depending on the sector. For example, for commercial sector, we separated between shipments going to new building or existing buildings. For the one going to new buildings, it's driven by commercial floor space growth as projected in the annual energy outlook publication.

In the industrial sector we used a different indicator the drive the sales, which was investment in -- investment in equipment and structures, that would include fans. This is just detailed so I'm going to go through this and this is just sort of the resulting projections for the 30 years. And combining the shipments projections to all the influx from the LCC, we calculated the national impact. And as this results, so first in terms of national energy savings expressed in full fuel cycle, which is not the electricity but all the upstream electricity use. And also expressed in terms of energy being -- so again, I'm just going to go through these, because there are just result tables. These are just combined and expressed in terms of ducted or unducted. And the next slides that I have here, it's the revised analysis, so similar input date, similar methodology, the only thing that we change is that we used a metric based on the static efficiency, as a function of flow and pressure for unducted fans.

So I don't know if you want to take a quick break and go back to the LCC input data?

MS. PETRILLO-GROH: I have one question. On the shipments and national impact analysis, the ratio of new buildings to existing buildings doesn't seem to make sense.

Can we speak a little bit more about that?
MS. IYAMA: Um --
MR. STARR: It's the colored graph.
MR. SMILEY: Yeah, the colored one. That assumes most of the market is going to be new building construction.
MS. IYAMA: Yeah.
MR. STARR: Fans last a long time, right?
MR. SMILEY: Yes, they do.
MS. IYAMA: So I think we were at a ratio of 80 and 20 percent. But --
MR. STARR: It's right here, (indiscernible).
MS. PETRILLO-GROH: I don't think I have it.
MS. IYAMA: I'm going to go back and check where that exactly came from. But --
MR. STARR: Air handlers.
MS. IYAMA: So --
MR. STARR: Air handlers you'd --
MR. FERNSTROM: So this is, this is Gary. I think a question here is how do we treat building renovation? So if someone is remodeling an existing building, is that considered a new building or an existing building? If renovation is considered existing building, then I could see how you might have a higher number than if it were just replacement of equipment that they don't --
MR. STARR: So, this is close. I think part of

what maybe drives the fan life this, I mean, for what they have right now, it's 30 years, so if that's not right, then that's going to maybe change the balance of those two. So I think if you change the fan life, it would switch those. But I don't, I actually don't know how long a fan lasts.

MR. FLY: This is Mark Fly with AAON, just from the motor people's standpoint, what do you think, what do you estimate is the life of a motor?

MR. BOTELER: We go with the DOE, that's 18 years.

MR. FLY: Eighteen years?

MR. BOTELER: Uh-huh.

MR. FLY: Okay.

MR. BOTELER: But let me tell you, some last much longer.

MR. FLY: All right.

MR. BOTELER: I've been in water plants with motors older than me.

MR. FLY: Yeah.

MR. BOTELER: Really.

MR. FLY: Yes, Gary? And I've seen fans that lasted a week.

MR. FERNSTROM: Right, fair enough. That's --

MR. FLY: Would this apply?

MR. BOTELER: They get repaired many times, and bearings and things.

MR. SMILEY: This is Bill Smiley, Trane. What is the typical design life for a motor?

MR. BOTELER: I'm sorry?

MR. SMILEY: Do they make -- what is the typical design life for a motor? Do you make a motor to last 18 years at, at some --

MR. STARR: I think you got industrial --

MR. SMILEY: -- acceptable failure?

MR. STARR: -- you got industrial motors, sure.

MR. SMILEY: Is it 10 or 20? What about --

MR. STARR: I'd say five.

MR. BOTELER: Commercial would be less. It wouldn't be 30.

MR. STARR: Yeah, but --

MR. SMILEY: Okay.

MR. STARR: -- keep in mind, you just replace the motor. You wouldn't go out and replace the fan, right? Right?

MR. SMILEY: Yeah, the equip -- our equipment design life isn't 30 years.

MR. STARR: Well not, so we're not talking about air handlers anymore. It's like exhaust fans and --

MR. SMILEY: Well --

MR. STARR: Yeah, I don't --

MR. SMILEY: Well, that could be. I'm just stating that for a sizable share of the market, which there's no data provided yet by us, there, the design life of the equipment is not 30 years.

MR. STARR: Your fan wheels don't last that long though, right?

MR. SMILEY: But if the equipment breaks down --

MR. STARR: You'll replace --

(Simultaneous conversation.)

MS. PETRILLO-GROH: Just retain the fan.

MS. IYAMA: So I just want to continue really quickly on the revised results that some of the members of the, well, I think everybody in the working group wanted to see, a revised analysis with a static metric for unducted fans. One of the starting point for the conducting this analysis was establishing efficiency levels in terms of static efficiency. And so here we have just a presentation of these targets. So before we were using 0.54 to characterize the EL-0, in terms of total efficiency target and in terms of static, we use 0.5, et cetera, all the way down. The way we kind of developed this target was to reach similar levels of noncompliant fan selections, whether it was for ducted or unducted fans.

MR. DYGERT: Excuse me, I have a question here real quick. It's Ryan Dygert at Carrier. Just note that the discrepancy in static efficiency and total efficiency is very small across that fan. There are only four points, and then it's constant (indiscernible).

MS. IYAMA: So I think you're, you're right. I think the typical difference between a total and static efficiency would be more something like, at least above 10 percentage points. So that's one way that we could kind of adjust these targets. The way that we did it here was to say, well, what's the target expressed in terms of static efficiency that leads to similar impact on the market?

MR. WOLF: There's other constants in those two calculations besides the efficiency, right?

MS. IYAMA: Right, so we use --

MR. WOLF: I think that's important for us to know. It's not just the efficiency constant, there's --

MS. IYAMA: Right.

MR. WOLF: -- other constants that help shape that 3D --

MS. IYAMA: Right. So we used 250 and 0.4.

MR. WOLF: Right.

MS. IYAMA: For both cases.

MR. WOLF: Okay.

MS. IYAMA: For all cases. It's, and these are just the revised results for all the analysis. Same thing. I don't think we have much time to go through them. And just to answer your question, Mark, Mike, these were sensitivity analysis that were done based on different values for the constants. And you can see doesn't really have a strong impact on the number of compliant or noncompliant selections. We just changed, you know, Q-0 and P-0 (phonetic sp.) and looked at how one fan would fail or pass. Here it's a sensitivity analysis based on different reselection criteria for size. So in the analysis, we were pretty strict, we didn't allow for changing diameter. Here what would, the analysis would look like if we allowed, you know, up to two nominal sizes and here another sensitivity scenario, so.

MR. WOLF: Yeah, the challenge to you guys here, you only had what was in the database.

MS. IYAMA: Yes.

MR. WOLF: Prepared for you, so it would be good for us to go back and look at this probably a little --

MS. IYAMA: So, you know, we can do more of these, sort of, sensitivity scenario as requested.

MR. WOLF: The other thing, just to clarify, this was, this is what we, we had a little bit of a different result, right?

MR. SMITH: Right.

MS. IYAMA: Right.

MR. WOLF: Between that and the fans, we got to --

MR. SMITH: I'm just trying to think of a task list so now --

MS. IYAMA: So, I, so do you want me to address your question that you sent --

MR. SMITH: You can, sure.

MS. IYAMA: Yeah.

MR. SMITH: If you want.

MS. IYAMA: So I, so --

MR. WAGNER: This is Greg, and one of the things that struck me, too, in that fan substitution equation is that within 20 percent of flow or within 20 percent of pressure. That's a pretty broad range and I certainly would love if my customers allowed me to get away with that.

MR. SMITH: Greg, I think that they were doing was, this is Wade Smith, they were looking for another fan that was that close to the design point and the assumption is that if a fan was sold that close to the design point in question, that it could be sold at the design point in question.

MR. WOLF: Yeah.

MS. IYAMA: We use the fan laws to adjust the --

MR. SMITH: They use the fan laws to adjust. So I don't think that's necessarily all that wrong. It's not that the replacement selection operated at a different operating point. It's just that if it was available for sale, had been sold at an operating point within 20 percent of the design, then they assume that it could be sold at the design.

MR. SMILEY: And speed it up or slow it down, or.

MR. SMITH: Yeah, exactly.

MS. ARMSTRONG: Yeah, you could tweak it.

MR. WAGNER: Yeah, but that changes, that changes the efficiency numbers, so.

MS. ARMSTRONG: Right.

MR. SMITH: Well, which they've done also.

MR. WAGNER: I don't know if it's the (indiscernible) controls.

MR. SMITH: Yeah, which they did also.

MS. ARMSTRONG: Ours did, too.

MR. SMITH: Right.

MS. ARMSTRONG: Then also the --

MR. SMITH: They used the fan laws to guide it down to the design point, then calculated the efficiency at that level. Right? Right.

MR. WAGNER: Okay, so they adjusted the efficiency for the change of glow and pressure?

MR. SMITH: Yes, sir.

MR. WAGNER: As well as, as well as changing the speed adjusts the flow and pressure?

MS. ARMSTRONG: So --

MR. SMITH: Right.

MR. WAGNER: So instead, it was within the parameters, you know, after you adjusted for all that?

MR. SMITH: Right.

MS. ARMSTRONG: Yes.

MR. WAGNER: Okay.

MS. ARMSTRONG: All right.

MR. ERNST: On slide 65 and 66, you have INPV after. What does that?

MS. IYAMA: Say, Mr. -- I'll let Sam answer to that.

MR. JASINSKI: I'm sorry, what was the question?

MS. IYAMA: INPV.

MS. ARMSTRONG: Industry Net Present Value.

MR. JASINSKI: Yes, but what's the question?

MR. ERNST: What it stands for?

MR. SMITH: What it stand, what INPV stood for?

MR. JASINSKI: Oh, what it stood for. Yes, Industry Net Present Value, sorry.

MR. SMITH: It was a test. So they, I feel like we should have a, you know, the majority of members should go home with a homework assignment on this analysis and we ought to try and figure out what are the most important things to try and get done.

MS. ARMSTRONG: Why don't we, let us, may I suggest that given your feedback that you've said today, can we come up with a potential list to send around?

MR. SMITH: If you would like. I would hope that it would be, include operating hours --

MS. ARMSTRONG: Okay, part of it.

MR. SMITH: -- and part load consideration.

MS. ARMSTRONG: Uh-huh.

MR. SMITH: And cost relationship to efficiency different than what is assumed. What else guys?

MR. SMITH: Equipment life.

UNIDENTIFIED MALE: End of life.

MR. SMITH: Equipment life. How about this one, recovery period for conversion costs? Well, what other manufacturers here think about a reasonable period to recover conversion costs?

MR. FLY: This is Mark Fly with AAON, it needs to be designed product wise, not equipment wise. Not how long it lasts (indiscernible) long it can operate for sale.

MR. SMITH: And so what do you think?

MR. SMILEY: That's the maximum.

MR. SMITH: Yeah.

MR. WIGGINS: And that's the maximum. So, you know. It depends a lot of how often we're going to revisit these efficiency levels.

MR. SMITH: Well, the statute says every six years.

MR. FLY: So that would be the outside.

MR. SMITH: So six years or less.

MR. SMILEY: It's the financial decision that management usually makes, it's what they'll accept for the length of payback for any commercial or, I mean, capital investment. It's just financial, you know? What is it? It's not going to be 30 years.

MR. FERNSTROM: This is Gary, you know that's exactly the same thing --

MR. SMILEY: I think, for you guys?

MR. FERNSTROM: That's exactly the same thing with pumps guys.

MS. ARMSTRONG: Yup.

MR. SMILEY: What was the conclusion?

MR. FERNSTROM: Probably not 30 years.

MS. ARMSTRONG: No we ran, we ran different scenarios.

MR. SMILEY: Okay.

MS. ARMSTRONG: We want what they wanted.

MR. SMILEY: See the sensitivity?

MS. ARMSTRONG: Yeah, exactly.

MR. BOTELER: Motor guys won't comment.

MR. SMITH: And is there anything else that the members of the working group think that we ought to be working on?

(Off the record discussion.)

MR. ERNST: I think the AHRI members have to estimate the air handler redesign costs.

MR. FLY: Right.

MR. ERNST: And the safety testing, too.

UNIDENTIFIED MALE: It's going to be a busy room.

MR. SMITH: So it's important for you to hear what's coming what --

MS. ARMSTRONG: What did they say?

MR. SMITH: Do you want to repeat that?

MR. ERNST: The AHRI members have to estimate the air handler redesign costs and the safety testing for furnaces and electric heat.

MS. ARMSTRONG: Okay.

MR. ERNST: It's --

MS. MAUER: I would say, in the cases where you actually would have to change the fan.

MR. ERNST: Right.

MS. MAUER: I would agree. Because we don't have to change the fan, then.

MR. ERNST: Yeah.

MS. MAUER: There's no redesign.

MR. ERNST: And at the --

MR. FLY: Conversion cost doesn't apply if you don't have to change.

MS. MAUER: Right, and I'm just saying, it may be the case that in many cases you don’t actually have to change the fans.

MR. SMILEY: Well, we won't know that until the metrics' defined.

MS. MAUER: Right.

MR. SMITH: And I would suggest that you include conversion costs when the fan substitution is not from the same manufacturer.

MS. ARMSTRONG: Yeah, so we should talk about that. Because I'm not sure if I agree with that.

MR. SMITH: Okay.

MS. ARMSTRONG: Just generally speaking.

MR. SMITH: Go ahead.

MS. ARMSTRONG: You know, I, I, you're telling me that as a customer, I will always buy from the same supplier no matter what. That, that's what I'm -- because by doing that, but you're saying that I'm not going to shop around, essentially.

MR. SMITH: No, I'm not.

MS. ARMSTRONG: You are, because that's what you would do if you implement a situation where the redesign is always limited by the ability for that same manufacturer to produce more efficient equipment, and that wouldn't be a competitive market.

MR. SMITH: The question is, what's the burden on industry. And the answer is if you're --

MS. ARMSTRONG: But that's not reality.

MR. SMILEY: Whoa, whoa.

MR. SMITH: Let me finish.

MR. SMILEY: Whoa.

MR. SMITH: Let me finish, please.

MS. ARMSTRONG: You see, a manufacturer --

MR. SMITH: Right. If you're a manufacturer and you're selling a fan that becomes noncompliant.

MS. ARMSTRONG: Yup.

MR. SMITH: What you said is exactly what would happen. Either that manufacturer is going to redesign a product to become compliant --

MS. ARMSTRONG: Right.

MR. SMITH: -- before the deadline. In which case, conversion costs are appropriate. Or, they don't. Those are the two choices. If they don't, the customer buys from somebody else.

MS. ARMSTRONG: Yeah.

MR. SMITH: The sales of the manufacturer who lost the business went down. Generally speaking, manufacturers are not happy --

MS. ARMSTRONG: Yeah.

MR. SMITH: -- when their sales go down. So they meet in a meeting with not so many people as you have here, and say, you know what, we got to solve this problem and their going to invest to recover their market share. Which is my point. That if the product that is substituted for a noncompliant product is not from the same manufacturer, the manufacturer who made the noncompliant product will invest to change their product line. And they're going to change their product line with an incurred conversion costs, and it's a burden on the industry that you haven't included.

MS. ARMSTRONG: Yes.

MR. SMITH: So what I'm --

MS. ARMSTRONG: But that's going to depend on what you're asking.

MR. STARR: One thing I would say about that way that has, let's say I, you have Carnes that makes a particular kind of fan. And the regulations go in and their fan doesn't meet it at a particular design point in the flow. There may be another design point that they have a real good product offering in the market, so maybe Greenheck will pick up that sale that Carnes couldn't make. But at the same time, Greenheck may lose in a sweet spot that Carnes has, and so they have market segments maybe where they're, in other words --

MS. ARMSTRONG: There's some pushing.

MR. STARR: -- they won't need to go into that meeting because they'll have the --

MR. SMITH: The pushing --

MR. STARR: -- same amount of sales, right?

MR. SMITH: Some shifting and consolidation, that's what you're saying, right?

MR. ERNST: And that's an area, you move for a monopolist?

MR. SMILEY: Exactly.

MR. ERNST: Right? Your pricing doesn't take that into consideration.

MR. SMITH: I think the more likely scenario, actually, is that Carnes wakes up one afternoon and says, you know what? We don't have enough money to do that. So they abandon that segment of the market, or they shut down their factory in Verona, Wisconsin and move it to Juarez, Mexico.

(Simultaneous conversation.)

MS. ARMSTRONG: It's not that we can't model a variety of different scenarios, and obviously, I think the answer is probably somewhere in the middle, right? That it won't be necessarily, there will be some shifting going on, and hopefully shifting not at a level that -- what we do want to understand is, we don't want to disserve the market. I mean, today there are competitive effects that, cost shifting, for whatever reason. You guys do it today and I think we can model that. But I don't think a straight manufacturer to manufacturer, the same one, A to A substitution is also the right way to that. It may be some balance around that scenario.

MR. SMITH: Right, so I've been a manufacturer most of my life and trust me, if I have a product that's about to become noncompliant, it's highly likely that we will invest to protect that product line. Highly likely. If we have a product to substitute from our own product line, maybe not.

MS. ARMSTRONG: Right.

MR. SMITH: Maybe we just say we're just going to shift over. But if we don't, highly likely that we're going to make that investment.

MS. PETRILLO-GROH: So, actually, is it possible to model the first look at the same, within the same manufacturer and --

MS. ARMSTRONG: Yeah, we can.

MS. PETRILLO-GROH: -- then task that?

MS. ARMSTRONG: We can model, so keep in mind, we're modeling the industry. It's not a given, specific manufacturer and how they are situated. Yeah, we can model for that scenario. We'll take a look.

MR. BUBLITZ: Are we winding down? Mark Bublitz. I'd like to, can we propose a transition to a new topic?

I'd like to understand more about ratings and manufacturer representation and for those of you that have been regulated already, this is probably old hat. But it's confusing when thinking about the data have and how that data will have to change, or may have to change, or may not have to change, post regulation.

MS. ARMSTRONG: Right. You want me to talk about that a little bit?

MR. BUBLITZ: I would really appreciate that. I think you're the source.

MS. ARMSTRONG: Can we do one thing real quick? Can we take a five minute break so I can get --

MR. SMITH: Absolutely. I'd like to have a while break.

MS. ARMSTRONG: -- some slides or whatever else you may want? So, I'm going to talk on a high level and with some examples of kind of how we talk about ratings and the development of such ratings or representations with a respect to what we currently do every other, most every other piece of equipment, and then what this would look like if we did the same thing for fans. And this is not meant to say this is what we should do. This is not meant to say this is what we have to do. But this is so you understand that if we took the regulatory approach, as it exists today, for most other products we cover, this is kind of what it would look like for you. I, I'm going to do these slides with the caveat that we put them together in the last hour and a half on the slide over there, so we may go back and, you know, put some additional meat on them as, before they are handed out, but.

So, basically you guys asked how we rate a basic model. And the way this works is, generally speaking, at least two units are selected at random from a given basic model to be tested. You would do the selecting for certification. So I think some units for some products we have more than two required. There's never, I don't think there's any instances off the top of my head where just one is allowed. The idea behind a multiunit sample is that it takes into account the variation coming off the production line. So each sample, each unit is tested in accordance with the DOE test procedure. To account for these variations, the manufacturer processes at the times when the manufacturer is testing, so the subject we have control over, we apply what we call certification statistics. They govern how you can rate your equipment. We do that by using competence limits. A competence limit's change depending on the product, and obviously that would be something that we would be specific to here. And then it governs how you can make representations. DOE's regs generally speaking allow you to rate conservatively all the way down to the standard.

Even if you have test data that shows that you can rate higher, that part of it's going to be at the discretion of the manufacturer. So I'm going to walk through what this means for fans.

MR. PERSFUL: So, so if, this is Trinity, Twin City Fan, so if we wanted to, we could always rate at the bare minimum and say that this product is compliant and, essentially, has a zero risk of fines or whatever it may be called. Yet we give up, I mean, we give up other stuff I would assume. Like utility rebates type stuff. But if that was, would that be a true statement that we would be able to do that if we wanted to?

MS. ARMSTRONG: So I'm going to take that zero risk of fines and stuff off the table. But to the extent you have, I mean, I'm not here talking as the enforcement person. But just generally speaking about the regs. To the extent you have test data that shows that your product can be rated somewhere at the standard or above, more, the fan has less consumption or above, then you would, you could rate everything right at the standard. If you showed, you know.

MR. PERSFUL: Fair enough.

MS. ARMSTRONG: We do have people for certain products that do. So, given what we've set up over the past handful of weeks, what this would look like, what would this mean for fans? So for each fan model, the regulatory perks that we've been talking about is that you are going to self-select and then self-certify the FER or whatever, just work with me here, FER at every operating point for which you decide to self-declare that you're going to sell that fan model. So in other words, you're going to define more operating points. You would then certify to this. In order to do that, you would have two methods for calculating FER at each of these self-declared operating points. So the first method is you'd have your tested BHP, you apply the nominal approach. That would be the default motor loses, the default transmission, and the default controls. So it would be your tested fans with the nominal things. You'd test two samples at each of the given operating points you want to claim for the BHP. You'd apply all the nominal to get your FER for --

MR. PERSFUL: Ma'am?

MS. ARMSTRONG: -- each unit --

MR. PERSFUL: Ma'am?

MS. ARMSTRONG: -- in the sample. So at the end of the day, you'd have two FERs for what's supposed to be a given fan at a given operating point.

MR. PERSFUL: I'm sorry, this is Trinity, I'm sorry, but the way my mind works, I try to find all the ways to do this. So when you say nominal, just make sure I've got my vernacular right. So if I take the nominal motor loss of, the motor nameplate says nominal --

MS. ARMSTRONG: No.

MR. PERSFUL: Okay.

MS. ARMSTRONG: You're going to take, I'm, maybe that's a bad word, because when we're talking about --

MR. PERSFUL: Yeah, don't --

MS. ARMSTRONG: Default, how about default?

MR. PERSFUL: Default, because that's, that's --

MR. DELANEY: It's not in my dictionary.

MR. PERSFUL: That's exactly, that's the exact point I was trying to get at.

MS. ARMSTRONG: How about default?

MR. PERSFUL: Okay.

MS. ARMSTRONG: We're going to give you the default values --

MR. PERSFUL: Okay.

MS. ARMSTRONG: -- that you're allowed to apply --

MR. PERSFUL: Okay.

MS. ARMSTRONG: -- pursuant to the past procedure.

MR. PERSFUL: Okay, that's --

MS. ARMSTRONG: No defaults are going to be look up tables that we've talked about, well, whatever. You're going to use the -- well, and basically it's like saying you're not running the wire to air test. You are applying to your fan test some default values to get out your FER, okay?

MR. PERSFUL: When you said nominal --

MR. FLY: So actually, this is Mark Fly with AAON, you anticipate having an AEDM or a fan law so that we don't have to test every model?

MS. ARMSTRONG: Right, we haven't got there yet, but I --

MR. FLY: Okay, I'm jumping the gun.

MS. ARMSTRONG: I would say that for a commercial, (indiscernible), so yeah, no issue. Okay, so we've gotten through this scenario. The key here is, the thing I think we need to talk about is whether, and this is not for, potentially feedback today, but it's whether you want to consider testing one sample for your fan efficiency, multiple samples for your fan curves. I mean, basically how many units of a given fan model do you test to get that representative, what you think is a fan curve. And I don't know need an answer today. It's something you probably want to think about. But it gets to the heart of what's your, your own test times in your lab if you have one, and then what's your manufacturer variation coming off your production line for a given fan line?

MR. MAGILL: Question.

UNIDENTIFIED MALE: It's 0.2 --

MR. MAGILL: John Magill with Howden. How do you plan to handle custom designs? One off?

MS. ARMSTRONG: So we do have ways to handle custom designs, we do have them in our regs for other equipment where there's one offs. There's a couple of different ways we can talk about doing it. I think depending on how we do it for the overall population that would feed into it, but a lot of people just typically use simulation methods, which is what he was getting at. With, we call those AEDMs in our regs. And they simulate the efficiency of the product, rather than testing at all. So that option is on the table, especially for custom built. There is some, there are some things you have to do make sure that your simulation is what I would call validated. For the purposes of comparing tested results and model results. But once we consider it validated, it can be used, you know, to write other untested model combinations. So that's typically what a lot of people do for custom built equipment. There's also other provisions with the reg to certification where we have different accommodations for custom built equipment.

MR. FLY: This is Mark Fly with AAON. And in our other product that we went through a lot of this, the engineered, what we called the engineered to order --

MS. ARMSTRONG: Yeah.

MR. FLY: -- side. You did have to, even though you didn't have to list it prior to operating it for sale, you had to list it prior to shipment. So before you shipped, you had to go on the DOE website and say this is my custom product, here it is. It went in, I think, a special section and stayed there some period of time (indiscernible).

MS. ARMSTRONG: Yeah.

MR. MAGILL: Is that available to the public?

MS. ARMSTRONG: Yeah, that's in our regs.

MR. MAGILL: But I have customers that wouldn't want that information divulged.

MS. ARMSTRONG: In other words you have customers that wouldn't want their operating characteristic divulged?

MR. MAGILL: Correct.

MS. ARMSTRONG: Okay, so you need to talk about, we probably should talk about at some point given the requests for a self-declared operating range as your regulatory approach. Okay? We don't, they would have an issue with, just to be clear, model numbers and operating characteristics?

MR. MAGILL: We don't have a model number. It's a unique one off design.

MS. ARMSTRONG: I get that part, but you say, for the purposes of certification, we made you say this Actually

123 and you would know what Actually 123 is.

MR. MAGILL: Uh-huh.

MS. ARMSTRONG: If we didn't put your manufacturer's name out there, but we did put model number information, Actually 123, which is meaningless to the world other than you, and DOE, would that still cause an issue?

MR. MAGILL: Perhaps.

MS. ARMSTRONG: Okay.

MR. MAGILL: Not sure.

MS. ARMSTRONG: Well, think about it.

MR. MAGILL: One of the customers is the U.S. Navy.

MS. ARMSTRONG: Okay.

MR. BUBLITZ: So at this, Mark Bublitz, New York Blower Company.

MS. ARMSTRONG: Yes?

MR. BUBLITZ: So at this point --

MR. MAGILL: I can't tell you --

MS. ARMSTRONG: Oh no, I --

MR. BUBLITZ: -- the manufacturers have one of, so we got on this path, one method is for a manufacturer to acquire, to manufacture two randomly selected products, test them, put it in a crank and out comes the metric.

MS. ARMSTRONG: Out comes the FER.

MR. BUBLITZ: Okay.

MS. ARMSTRONG: And you'll have two FERs. Well, if we go down this, two units --

MR. BUBLITZ: I, I --

MS. ARMSTRONG: You'll have two FERs, right? We're continuing. Okay, now we're going to go to FERs, all right? Wire to air. So I conduct a wire to air test for two units within a given, so one, two units at a given operating point, obviously you'll probably run in the standard operating points, but whatever. At the same time, that being said, you'll then use the DOE statistics to calculate the sample mean and the upper contents on it from the FER values, and then that will determine your allowable range for selecting a representative value. So you're probably looking at, what does that really mean?

MR. MAGILL: Right.

MS. ARMSTRONG: So purely illustrative, I made up numbers not based on anyone's particular product. But this is essentially what it would, will come out to be. You would have your BHP and BHP are the numbers you would get for a given test, two different units at the same operating points. You would get those values. Just say that those are the, that's the variation you see for whatever reason. You would then apply the defaults values as we give them to you in the test procedure, and you would get your FER values. These are the two values. If you apply how we typically govern ratings and representations, if you apply the statistics that govern that, you get a value for which you have tested FERs of 7.34 to 7.22. It is going to shift you down the bell curve, pushing you to rate conservatively if we used, I think this example we used a 95 percent confidence. No, this used a 97.5 percent confidence limit. You would be able to rate no less than a 7.66.

MR. SMITH: No less than?

MS. ARMSTRONG: No less than, the way this works.

MR. SMITH: So, and what --

MS. ARMSTRONG: And honestly, there's a lot of --

MR. SMITH: Oh, excuse me. This is brake horsepower?

MR. STARR: Yeah.

MR. SMITH: Or --

MS. ARMSTRONG: No, no --

MR. SMITH: -- or whatever?

MR. STARR: Yeah.

MR. SMITH: Import-wise.

MS. ARMSTRONG: Yeah. Right? There's a lot that goes into this, and like I said, I just picked random illustrative examples. We could pick the confidence limits, we could pick the number of samples, but this is generally speaking how this works and why this matters is because when you come out with a representative ER, FER, I should have put a number here. So let's just say the standard level of eight here, you could rate anywhere between 7.6 and eight, right? You could rate anywhere higher. You could opt, as Trinity said, as a business decision to go all the way conservatively to eight. You could rate everything. You could go somewhere in that range, because you want to make sure if DOE pulls a unit, or somebody else pulls a unit for testing, you're always going to get that or better. But you cannot go above this number, period.

MR. SMITH: Above or below?

MS. ARMSTRONG: Lower, sorry.

MR. STARR: I was like, what?

MR. SMITH: How did it, the factors that fend you from 7.28 to 7.66, what are those?

MS. ARMSTRONG: So it's going to be based on your competence and -- so what's driving that decision is the variation that you would experience in the manufacturing processes.

MR. SMITH: And this is at the discretion of the manufacturer?

MS. ARMSTRONG: Nope. We will set the competence limit. So some products it's 99, sometimes it's 97.5, sometimes it's 95, it just depends. But obviously we would like your input on, but setting those numbers does matter. Now, that being said, even if you set a 97.5 competence limit, if you do, if you have a really narrow bell distribution, you're going to be able to rate closer to your values of 7.3 -- closer to your tested values. So there is some discretion and control within the manufacturer, even though we're building in a competence limits. I mean, how wide that curve goes --

MR. BUBLITZ: You --

MS. ARMSTRONG: You get to see the variation coming off your line.

MR. BUBLITZ: So Mark Bublitz, Blower. And the way that you prove that that distribution is narrow is you either increase the number of samples --

MS. ARMSTRONG: Yes.

MR. BUBLITZ: But that doesn't kind of defeat --

MS. ARMSTRONG: Take, we take two or more.

MR. BUBLITZ: Or you find a way through manufacturing technology to make sure those numbers come out the same?

MS. ARMSTRONG: You got it. That's how this works. But why this matters is because at the end of the day, whatever that FER value that we tell is how you calculate it and how you have to certify that the same line you have is in your literature and your public representations and your marketing, voluntary programs and everything else. They can't have different numbers.

MR. HARTLEIN: This is Dan, quick question?

MS. ARMSTRONG: Yeah.

MR. HARTLEIN: I'm not sure how to raise my hand, sorry about that.

MS. ARMSTRONG: It's okay.

MR. HARTLEIN: But how does this work for custom equipment?

MR. FERNSTROM: So Dan, it's Gary here, sitting right next to me, and I saw you raise your hand.

MR. HARTLEIN: Oh, thank you, Gary. I appreciate that.

MS. ARMSTRONG: Yeah, so we kind of touched on that at the beginning. There are some nuances with custom equipment, one offs, built to order, we engineer to order. We can make accommodations for those. I would say focus the effort on this, what should this look like? And then we can talk about how that translates to custom equipment. Generally speaking, and you know, some of our other, in some of our other industries, there's a significant concern, understandably so, about testing every single custom built equipment. If a similar concern exists here, even for running fan curves, one solution to that is AEDMs, what we call simulating results rather than testing.

MR. HARTLEIN: But there is, outside of custom, there is a tremendous amount of equipment in our industry that is, I would call, semi-custom. It's quasi-custom. You know? Somebody has changed the, the width of a wheel, a diameter of a wheel ever so slightly to hit a particular duty point. That might happen once a year on a particular product. Does that become custom relative to this analysis?

MS. ARMSTRONG: So as a second term in our regs that we use, which is called basic model. And the basic model concept is really kind of like this made up concept for DOE regulations, but what it allows a manufacturer to do is group essentially identical units coming off a production line, essentially identical models coming, individual models coming off a production line, for the purposes of developing a rating and reducing the housework.

MR. SMITH: So, so --

MS. ARMSTRONG: Um --

MR. SMITH: Does that imply that in the example he chose, in the sample you used, he would declare this slightly different unit to have a 7.66 or would be able to use a AEDM to alter that number?

MS. ARMSTRONG: So the answer's going to be it depends. If we allow the use of an AEDM, once you have a validated AEDM pursuant to our regs, you can use it.

MR. SMITH: Okay.

MS. ARMSTRONG: You know, that would be an option. That being said, you know, we --

MR. SMITH: Likely that he's giving the 7.66?

MS. ARMSTRONG: Right.

MR. FLY: It's Mark Fly. The other thing that's going to happen with a basic model, when you group those, whatever you represent that basic model as, no model that falls in that basic model, that grouping of basic units in that basic model can be represented any higher in efficiency than that, and on tested it better meet --

MR. SMITH: Right.

MR. FLY: -- that requirement? So you can make your model groups depending on how we define it?

MR. SMITH: Right.

MS. ARMSTRONG: yeah.

MR. FLY: Rather broad, but you're going to be paying a lot of -- a lot of range of models, likely.

MS. ARMSTRONG: Right. And we, we try to allow you guys some flexibility. I mean, you can get it down to rating every single model that you make or you can do it as roughly as grouping hundreds of models (indiscernible).

MR. SMITH: Right so, what, what --

MR. BUBLITZ: I think I was first.

MR. SMITH: Go ahead.

MR. BUBLITZ: Mark Bublitz, New York Blower. So I have a, currently we have catalogs with lots of CFM, static pressure, brake horsepower, our data.

MS. ARMSTRONG: Yeah.

MR. BUBLITZ: And then I would have to, let's just, let's go down the model road for a second. Let's just assume that I have a model and I have a catalog. And attached to that model would be a test which creates a distribution which creates a rating. I won't, if I took my calculator out and I took the catalog data and I turned the crank, I wouldn't get the rated value. I would get, in theory, a number less than the rated value.

MR. SMITH: 7.28.

MR. BUBLITZ: Is that --

MS. ARMSTRONG: So what is it from your catalogs that's going to give you that --

MR. BUBLITZ: Well, the FER number. I'm going to take the brake horsepower and I'm not, I'm going to get --

MS. ARMSTRONG: Oh, right, you're going to get something lower then. I understand. It's not, it's meant to represent the population, right? But, technically, I mean, the way we would work, because that brings up a question about whether we should have a rating conversions for other things other than just FER. We weren’t going down that pathway, but we can talk about that, whether there's a disconnect between what would be in your catalogs versus -- we understand.

MR. ROY: So the UCL over here incorporates 97.5.

MS. ARMSTRONG: Right.

MR. ROY: So if we think there's better products, like let's say air conditioners, I think we see --

COURT REPORTER: Please keep your volume up.

MR. ROY: I think the UCL for that is 95 percent, in terms of rating. So is this up for consideration in terms of the competency is concerned?

MS. ARMSTRONG: Yeah, that's what I said.

MR. ROY: Because it likely that, you know, it'd depend, it would be different for covered equipment if we go that route.

MS. ARMSTRONG: I think it depends on how you test it, right? If you end up testing it and vet it there should be, a different version would be when you end up testing it free flow or stand alone and you're testing the configuration, meaning the variation is not that different from the rest of the fans we're talking about here.

MR. PERSFUL: Trinity, Twin City Fan. So for the last 20 years we have tested data, we have got our own lab and everything else. Can we retroactively use that test data to get these numbers? So we don't have to redo everything, or --

MS. ARMSTRONG: As long as it's in accordance with the DOE tests at the end of the day.

MR. PERSFUL: Okay.

MR. BUBLITZ: Slide one says a randomly selected sample. And --

MS. ARMSTRONG: That's on you to figure out. I mean, if you're testing what you have, if you believe is representative of your population. I mean, typically some manufacturers do this, in which case they have two units that you have to certify for distribution and commerce. And so you would certify the department, and then if they have a given model for which they don't see the life of that model is supposed to say 10 years, you know, they may spot check and add to that testing to over time. And to the extent you have data that no longer shows that your rating's valid, you are required to recertify. But if the rating remains to be valid, if you make slight improvements but don't want to claim such an improvement, that's okay. But if you wanted to claim such improvements, you better have the testing done that underlies your rating.

MR. MCNEIL: Donald McNeil, Buffalo Air Handling. We're a custom air handling unit manufacturer. We're buying our fans.

MS. ARMSTRONG: Okay.

MR. MCNEIL: I can see this excluded from reporting requirements, because we're buying a tested fan that's already rated. Do you see it the same way?

MS. ARMSTRONG: Well I was trying not to have to answer that question next.

MR. MCNEIL: Oh.

MS. ARMSTRONG: So I think it depends. I will say, because we don't have fan regulations, I'm not going to say what it would mean to fan people. Right now, certification is based on manufacturing and imports. So if you were an importer, you would still be required to certify for most other products. But that being said, you know, I don't know if we would be willing to entertain other things here, in terms of that, but that is a nuance. It would be the fan manufacturer, but it would also include the importer if someone, if a different entity was importing a box of fans (indiscernible).

MR. MCNEIL: Okay, and I have a second question. What if we used the fan and that was later discovered not to meet the requirements?

MS. ARMSTRONG: Um --

MR. MCNEIL: How do you find this? Or find where the equipment is or whatever?

MS. ARMSTRONG: So I don’t think that's something --

MR. MCNEIL: I don't want to put

MS. ARMSTRONG: -- that I can actually answer. I don't think that, I mean, that really gets to our team of lawyers and how they deal with specific enforcement investigations. But I would caution that you'd be surprised.

MR. MCNEIL: Okay.

MR. BUBLITZ: And this specific to how we will be allowed to present information in markets. This is not portion testing, sampling --

MS. ARMSTRONG: No, it's a specific to just how you're, how you come up with your representive, what I'm calling your representative value. That's going to be the value that you get certified to the department, but that's also going to be the value you show in your literature and everything else.

MR. HOWE: Okay, so hopefully you can just --

MS. ARMSTRONG: Right.

MR. HOWE: -- up for me. Nick, Carnes. Right now, my catalogue's got 5.92 and 5.87.

MS. ARMSTRONG: Yup.

MR. HOWE: So let's just say this is a belt drive fan. So we had the motor losses drive us low. We get to 7.34.

MS. ARMSTRONG: Yup.

MR. HOWE: But the guy buying it saw 5.92. He said all right, I'm going to buy your fan, I'm going to stick a 7.5 horsepower motor on it, because it's the next one. Now, you add the rest of the stuff, I add my confidence and I'm at 7.66. So he goes, well, I'm over my 7.5, now it's got a 10. Did that just hurt the whole purpose for sitting in this room?

MS. ARMSTRONG: It didn't hurt the whole purpose for sitting in this room. But I mean you're fundamentally asking me to -- no. I mean, we're all here with great purpose, right? And great intentions. And, but if downstream of you someone -- I don't have an answer to this, by the way, but you're asking what happens basically outside of the fan manufacturer's purview and other product, and other components less efficient than the nominal components are added to my product and thus, you know, erasing the 7.66 gains that I thought I was going to be getting. Is that what you're asking, more or less?

MR. HOWE: (No audible reply.)

MS. ARMSTRONG: I don't think I can answer that, per se. At least at this point in time.

MR. SMITH: Well, on the surface, I would speculate that the manufacturers would be very comfortable with a requirement that relates to their representation of the FER from, in this, and would be delighted if that was the end of the restriction on what they chose to move in the marketplace.

MS. ARMSTRONG: What does that mean?

MR. SMITH: What that means is that they would like to publish the airflow and the pressure and the RPM of their fan that ties to their confidence and their traditional practice in the marketplace. The power input is restricted by a DOE regulation, and they would deal with that. So that, I mean, I'll be certain, not happy to, but I'll be certain to survey our members to make sure that that's -- I'm pretty certain that's the case. The second thing I wanted to --

MS. ARMSTRONG: And I mean, just to be clear, when you're talking about, just to make sure I understand you, though, before we move on. When you're talking about those other operating ranges, I mean, those are discrete points that they're going to certifying with different FER values? I mean, that's what's going to --

MR. SMITH: No, they aren't going to have different FER values because you just told us we couldn't.

MS. ARMSTRONG: Well, every operating point.

MR. SMITH: Every point? Every operating point? Well --

MS. ARMSTRONG: Every operating point will.

MR. SMITH: Every operating point will have a different FEI or FER, yes.

MS. ARMSTRONG: And we've set this up so that you're going to self-declare what those points are, thus --

MR. SMITH: Right.

MS. ARMSTRONG: -- defining --

MR. SMITH: This is the range --

MS. ARMSTRONG: -- your rate.

MR. SMITH: -- over which we are selling this fan.

MS. ARMSTRONG: And so you're asking, can they make representation of other attributes, other characteristics of their fans outside of the FER, but as long as they're within that same range, correct?

MR. SMITH: Yeah.

MS. ARMSTRONG: We allow that for other things, so I'm not sure why that would be off the table here.

MR. SMITH: And then the other comment I'll make, I think you know this, but I just want to be clear. It is, you know, a tradition in our industry to test several fans to rate an entire product line. Not each fan's size in that product line is tested in order to determine the ratings. But rather, a well proven AEDM that's related to the fan laws, basically, allows one to do that. So the idea of having to test two fans in a product line is no burden at all. It is also true, however, that as you, the ratings standard that is used extrapolates up from a test to larger sizes, but not down. And that is because that as you move up the ratings become more conservative. Which is a manufacturer doesn't rate an entire product line from one fan. They pick various sizes, recognizing that they're driving themselves to be conservative as they extrapolate up. So with that understanding, then we'll do whatever is required to win your support of the AEDMs that are used.

MS. ARMSTRONG: I --

MR. SMITH: There's no problem.

MS. ARMSTRONG: I wouldn't necessarily call it an AEDM, but I think --

MR. SMITH: Well, it is.

MS. ARMSTRONG: Well, that's just a calculation of that, right?

MR. SMITH: Yeah.

MS. ARMSTRONG: I mean, we can -- that's no issue.

MR. SMITH: Yeah, okay.

MS. ARMSTRONG: That being said, though, I just want to follow up on some things. You test, just explain to me what you do. You test two, two or more currently for an entire line, which may expand sizes?

MR. SMITH: Yeah, let's --

MS. ARMSTRONG: Or do you test --

MR. SMITH: The example you might have is a product line, they go from 24 to 72 inches. And in the 24 to 72 inches, there's 10 different diameters. Yeah, probably, they would test two fans in that range, two different sizes, and rate the entire range.

MS. ARMSTRONG: And just to be clear, there's never a case where you test two 24 inch fans?

MR. SMITH: Not unless we make --

MS. ARMSTRONG: I would go as far as to say that's what this would --

MR. SMITH: You have it exactly right. We'll have to double up on everything, yes.

MS. ARMSTRONG: -- require you to, so if that's not what we want to talk about, if that's not what we want to do, if you believe the variation --

MR. SMITH: Yeah.

MS. ARMSTRONG: -- is captured if you test just two in that diameter or range and use the fans for others, that's something that we need to have a discussion about. Because I write the regs the way they are for the other products, I don't believe that you could continue to do it that way.

MR. SMITH: That, okay. So that is what we believe. And the statistical support for that belief, in our certification program is, that every three years we test a model in this product range that has never been tested before, at our lab, at the AMCA lab, and we pull it in and the manufacturer's at risk if that unit rated with mathematics, if that unit is not, does not perform correctly. And the confidence level that our members have in that rating method is very, very, very high.

MS. ARMSTRONG: I'm not questioning, necessarily, the validity. I'm questioning what it is that you wanted us to consider. So perhaps you could take that back and let us know.

MR. SMITH: Okay.

MS. ARMSTRONG: As a group of you, a wholesale, exactly what it is. And I just wanted to make, there is a nuance from DOE between, you know, given fan model, the specific diameter and specific attributes versus the entire product line which may span, you know, different sizes, different lengths.

MR. SMITH: So that's certainly our ask.

MS. ARMSTRONG: And so Armin, I have a question for you, now.

MR. HAUER: Yes?

MS. ARMSTRONG: So for wire to air, do you guys test every combination of fan/motor/drive system that you might want to offer to come up with a rating, exclusively? Do you test more than one unit of each of those, or do you test some and then also extrapolate some?

MR. HAUER: We test all basic models.

MS. ARMSTRONG: All basic -- and one unit of each or multiple? Multi-sampled, is what I would say.

MR. HAUER: Well, because of our precious control we will need multiple fans as well.

MS. ARMSTRONG: Okay.

MR. SMITH: Right.

MR. HAUER: So we have preliminary data, you know? And then we make 10 samples and then --

MS. ARMSTRONG: Okay.

MR. HAUER: Yes.

MS. ARMSTRONG: So you (indiscernible)? Okay.

MR. PERSFUL: Trinity from Twin City Fans. What's the, if we sell to a distributor or OEM or somebody that's not usually the customer, what's their responsibility to pass on the rating or the performance, you know, the FER? What's --

MS. ARMSTRONG: It depends, they, I mean, it depends on what you guys decide you want to do with legally. Disclosures, those types of things. It depends on what we define, what DOE ultimately defines is a fan manufacturer and who that entity is. It depends on what we went up seeing is the testable configuration in terms of who that entity is responsible. So the answer is, I don't know yet. But if you have specific proposals for which you want the group to consider about legal disclosures, those types of things, and the information that needs to be passed along, we welcome that. I have no idea what time it is. Everyone's standing. I take it it's time to go?

MR. SMITH: It's 3 o'clock.

MR. STARR: It's 3 o'clock.

MR. SMILEY: 3 o'clock.

MS. ARMSTRONG: Go. I'm here to answer questions if you want them.

MR. ERNST: If, I don't, I haven't --

MS. ARMSTRONG: Safe travels.

MR. ERNST: -- been to many of these meetings, but have you yet thought about what type of information was submitted to DOE from the fan manufacturers? Since it's an envelope that would be a computer program or something pretty complex, I guess, right?

MS. ARMSTRONG: No, I don't think we thought it was going to be a computer program. I mean, they're going to come off the, they may have a computer program that comes up with discrete readings, but I think it'll look more like a table.

Yeah?

COURT REPORTER: I can't hear you over the talking room.

MS. ARMSTRONG: Okay. So we can stay here and continue talking, we can wrap up and pick it up next time. Whatever you guys want to do.

MR. SMITH: I just have one more question that I think everybody would be interested in. Okay. Imagine this scenario, we have a fan that's rated just as you describe based on an airshaft test, and FER rating is applicable to any time I sell that fan with an airshaft and people couple it with other things. Imagine that I also want to offer this same mechanical fan with a particular motor and drive that I carefully select and I select that motor and drive based on its efficiency. Now it's motors and drive, because it's a range, so it's going to involve more than one motor. And the motors and the drives are collectively more efficient than the default values.

MS. ARMSTRONG: Yeah.

MR. SMITH: So we understand that we can test the wire to air and demonstrate using the test method that the efficiency is higher and we can offer that package, that extended product, at that higher efficiency.

MS. ARMSTRONG: It is a different, certified, basic model?

MR. SMITH: Right. However, can we use AEDMs to determine the efficiency of this infinite number of operating points for the extended product?

MS. ARMSTRONG: Well, I think that's up to us to talk about, right?

MR. SMITH: Okay.

MS. ARMSTRONG: We don't have, you know, at this point, we don't have lines that govern AEDMs to the fans.

MR. SMITH: Okay.

MS. ARMSTRONG: We have some AEDMs that can be widely used. We have other AEDMs that have bounds around them. If you believe that, you know, for a specific motor and drive and then package and sold all together, a working group feels that they should be tested, then we put those regs in place. So we consider putting those regs in place. We, right now, it's a white sheet of paper.

MR. MCNEIL: Donald McNeil. If they do the test, do I have to buy the motor and drive from them? The fan manufacturer, or can I buy an identical motor and drive through other channels?

MS. ARMSTRONG: Well, in theory, if they're offer -- if the fan manufacturer is offering for sale a fan, independent of a motor and drive, for which they rated with nominal values, you're buying that base model. Because you're doing your own motor and drive thing. And then they're also offering for sale this other system package that has that same fan, but a specific motor and drive, and so it's essentially, in DOE's mind, two separate models. You're taking this one and doing your own thing and they're taking this one and claiming higher efficiencies because they've taken into account system effects that they wanted to optimize.

MR. MCNEIL: Even though I bought the exact same motor, the exact same drive that they tested?

MS. ARMSTRONG: Are you asking to recertify it?

MR. MCNEIL: No. That's the answer.

MR. SMILEY: You don’t get to put the number on it.

MR. SMITH: So you want a motor AEDM, or a drive --

MS. ARMSTRONG: They have them. They have a motor one.

MR. SMILEY: So, for example, we can have --

MS. ARMSTRONG: Anyhow, so we can have, we can talk about this. These are all topics to talk about, but hopefully this was somewhat helpful for your parting gifts on the way home. Like I said, I'm going to make some tweaks to these slides, just because we didn't have a whole lot of time to put, at least, an explanations behind it. So when they're sent out that at least somewhat makes sense. But thank you for coming, we'll see you in a couple weeks.

UNIDENTIFIED MALE: Yes, ma'am.

MS. ARMSTRONG: Lucky for you, you were able to get the room up the street, so bigger and it has a cooler. So we'll send out a reminder that we're going to be up the street then. I think it's the 22nd, 23rd?

UNIDENTIFIED MALE: So the schedule shows one day over there and one day back here?

MS. ARMSTRONG: So both days we're going to go to there.

(Whereupon, the meeting was concluded.)

√ Digitally signed by Nicholas Allen

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ASRAC FANS AND BLOWERS

WORKING GROUP MEETING

By:

Nicholas Allen, Transcriber