

DOCKETED

Docket Number:	19-BSTD-03
Project Title:	2022 Energy Code Pre-Rulemaking
TN #:	235068
Document Title:	Transcript of September 23, 2020 Workshop
Description:	N/A
Filer:	Cody Goldthrite
Organization:	California Energy Commission
Submitter Role:	Commission Staff
Submission Date:	10/6/2020 8:39:06 AM
Docketed Date:	10/6/2020

CALIFORNIA ENERGY COMMISSION

In the matter of:

2020 Energy Code) Docket No. 19-BSTD-03
Pre-Rulemaking:)
)
Computer Rooms, Compressed)
Air Systems, and Refrigeration))
_____)

WORKSHOP

REMOTE VIA ZOOM

WEDNESDAY, SEPTEMBER 23, 2020

9:00 A.M.

Reported by:

Elise Hicks

APPEARANCES

CEC STAFF

Payam Bozorgchami, Project Manager

Haile Bucaneg, Senior Mechanical Engineer

Ron Balneg, Mechanical Engineer

Cheng Moua, Mechanical Engineer

ALSO PRESENT

Hillary Weitze, Red Car Analytics

Lisa Saponaro, Vertiv

Jon McHugh, McHugh Energy Consultants

M M Valmiki

Trevor Bellon

PUBLIC COMMENT

Laura Petrillo-Groh, Air Conditioning, Heating, and
Refrigeration Institute

Meg Waltner, Energy 350

Nick Harbeck, Air Conditioning, Heating, and
Refrigeration Institute

P R O C E E D I N G S

9:05 A.M.

WEDNESDAY, SEPTEMBER 23, 2020

MR. BOZORGCHAMI: Good morning everyone. My name is Payam Bozorgchami. I'm the Project Manager for the 2022 Building Energy Efficiency Standards. I want to welcome you to the --

MS. BECK: Payam, can you please push record?

MR. BOZORGCHAMI: Yes. I always forget. Thank you. Thank you, Amber.

I want to welcome you to the Commission's workshop, Pre-Rulemaking Workshop for 2022 Energy Standards. Let me provide you with some housekeeping rules.

We will be muting everyone. And after each proposed measure is presented, you can either raise your hand and we will un-mute you, or you can submit your questions in the question and answer window and we'll try to answer your questions as soon as we can. If we notice the question is a little bit too long, and it's going to be our discretion, I will un-mute you and you

1 can ask your question so everybody else can also
2 participate.

3 If you're calling by phone, you can use
4 the star six to mute and un-mute yourself.

5 One important thing, as you all heard,
6 this workshop presentation is being recorded, and
7 it's also going to be transcribed. So the
8 information you see today as the PowerPoint
9 presentations will be posted tomorrow, early
10 morning tomorrow. And the transcripts will be
11 available later on, as soon as we get those back.

12 So with that, I think we should start.

13 So for the workshop today, we're going to go
14 through some basic backgrounds on how Title 24 is
15 developed.

16 Haile Bucaneg, our Senior Mechanical
17 Engineer here at the Energy Commission, will talk
18 about the computer room efficiencies. Ronald
19 Balneg, our Mechanical Engineer here at the
20 office, will talk about a proposed measure that
21 was provided to us by a private entity regarding
22 integrated pump refrigerant economizer as a
23 prescription option. We'll have Haile Bucaneg
24 again. He'll be talking about pipe sizing and
25 monitoring the leak testing of compressed air

1 systems. And Cheng Moua, one of our mechanical
2 engineers here in the office, will also be
3 talking about two new mandatory requirements for
4 covered processes.

5 So that -- with that, I'll start by
6 explaining how the Energy Commission was
7 developed. It was done by two California
8 Assemblymen, Assemblyman Warren and Assemblyman
9 Alquist, to develop what's known as the Warren-
10 Alquist Act. They proposed it to Governor Ronald
11 Reagan in 1972 where he signed it into bill. And
12 in 1975, when Jerry Brown came into office, he
13 funded it and we started what's known as the
14 California Energy Commission.

15 This was done to reduce wasteful,
16 uneconomic, inefficient, and unnecessary
17 consumption of energy in California. This Act
18 also gives authority to the Energy Commission to
19 develop the Energy Code on a triennial basis as
20 part of the Building Codes or Building Standards.
21 And these codes and regulations are to be
22 enforced by the local jurisdictions.

23 There's other areas that the Energy
24 Commission also have to look into as we're
25 developing the 2022 standards. These are

1 regulations, state bills, and assembly bills that
2 have been added on -- or senate bills, excuse me,
3 that's been added on to the work that we do here
4 at the Energy Commission. And it's really
5 looking at global greenhouse gas reduction goals
6 and looking at how to provide an option for
7 electrification for buildings, and self-
8 utilization also.

9 The work that we do here at the Energy
10 Commission is done with the help of our utility
11 partners. And the utility partners have been
12 very grateful and gracious in helping us out, as
13 Pacific Gas and Electric, Southern California
14 Edison, Sacramento Municipal Utility District,
15 Los Angeles Department of Water and Power, and
16 their consultants. They provide these measures
17 to the Energy Commission.

18 But prior to doing so they provide --
19 they do two utility-sponsored stakeholder calls,
20 meetings where each proposed measure is
21 presented, and they take feedback from the
22 public. And they try and answer all questions
23 and concerns and comments and develop what we
24 call a Codes and Standards Enhancement Document,
25 where it is a proposal to the Energy Commission

1 that shows the benefit cost analysis for every
2 proposed measure, based on the time-dependent
3 evaluations for the current 2022 Standards. When
4 they submit that to the Energy Commission, we
5 review and we provide these sponsored pre-
6 rulemaking workshops where we take more feedback
7 from you folks.

8 One of the things that we were trying to
9 do with the utilities is try to get your comments
10 and concerns earlier on, so we have a more
11 productive path moving forward with our Code
12 development. There's a lot that's happening and
13 within a little bit amount of time, this Code
14 cycle.

15 Right now, what we call the Case Team is,
16 through the utilities, are submitting their
17 proposals to the Energy Commission for review.
18 That will be happening until October. Staff has
19 been reviewing and providing presentations, as
20 you will be hearing today, in pre-rulemaking
21 workshops.

22 From there we take your comments and your
23 concerns and we develop the 45-day language. And
24 this language needs to be done and completed
25 within -- by September or end of September. And

1 we will have a workshop. This one will be a
2 Commissioner-led workshop in February. It will
3 be probably be three workshops, one for
4 residential, one for nonresidential, and one for
5 multifamily electrification. And within those,
6 we'll try to get the last set of comments to
7 develop what we call the 15-day language, which
8 becomes a document for adoption for the 2022
9 Standards. It will be happening at a business
10 meeting, hopefully, in July of 2021.

11 After that the Staff works on developing
12 compliance manuals, compliance forms, and working
13 on the -- and the computer modeling programs, to
14 really capture everything that we presented for
15 the July 2021 workshop for adoption.

16 We're trying to do this all one year
17 before the effective date of the standards. And
18 that effective date right now is January 1 of
19 2023.

20 And why one year? The one year is to
21 really make sure the energy consultants, the
22 local jurisdictions are trained, that third-party
23 verifiers are set to really take on the program
24 as it takes effect on January 1st.

25 So our schedule so far. We've had four

1 workshops so far. Our last one was yesterday on
2 outdoor and daylighting requirements. Today we
3 will hear about the nonresidential mechanical
4 measures. We will have a workshop next week.
5 This is a Commissioner-led workshop. It's a
6 roundtable, per se. It's discussions with the
7 scientists and researchers related to indoor air
8 quality and, in particular, to gas cooktop versus
9 electric cooktop and the particulates that are
10 emitted from cooking.

11 One of the key issues that everybody's
12 been interested in hearing about is the
13 electrification program and the process and
14 procedures. That workshop will be led by Mazi
15 Shirakh and that will happen. The first one will
16 be on October 6th where he will present what
17 path, what type of buildings we're looking into
18 this Code cycle, and how we're going to be
19 looking at electrification. And on November
20 17th, he will be presenting the final proposals
21 for -- to be embedded into Part 6 of Title 24 as
22 we move forward.

23 Key websites and links that you should be
24 -- you might be interested in. The first one is
25 the utility sponsors/stakeholders website. Here

1 you'll find all the information the utility and
2 the Case Team used to develop the proposals, the
3 proposals themselves are also located here, and
4 then past workshops that utility sponsors have
5 conducted for the proposals that you will be
6 hearing today also.

7 Our website, this information has all the
8 current regulations, current documents and
9 manuals, and it has the current proposed measures
10 that's come in through these workshops here.

11 The last link here is the most important
12 link. We need your -- we need you to submit your
13 comments on this workshop by -- excuse me, that
14 date is wrong, it should be October 7th of next
15 month for this workshop. I will fix this before
16 we send this out for you folks to review on our
17 docket. But I just want to make sure that if you
18 have any concerns, comments, that there's a
19 comment that we did not get to, please submit it
20 in writing here by October 7th to be looked at
21 and reviewed.

22 Some key Staff members here at the Energy
23 Commission. Mazi Shirakh, he will be -- he's the
24 lead that's looking at electrification and
25 decarbonization in California. Myself. Larry

1 Froess, he's our Senior Mechanical Engineer, and
2 his responsibility is the computer software
3 program and the performance packages. Peter
4 Strait, he's the Supervisor of the Building
5 Standards Development Team. Haile Bucaneg, he's
6 our Senior Mechanical Engineer, and you'll be
7 hearing from him today too. He's been a very
8 essential help to me in getting the 2022
9 Standards moving. And Will Vincent, he's our new
10 Office Manager here at the Building Standards
11 Office. This is second week. And right now he
12 does not have a phone number because we have not
13 been back in the office and there's not one been
14 assigned to him yet.

15 Again, I have the right date here. Due
16 date for this comment -- for this workshop for
17 comments is on October 7th. And this is the link
18 to submit your comments to.

19 Any questions?

20 Also, when -- during the presentation,
21 when I -- when you raise your hand and I un-mute
22 you, please state your name and your
23 affiliations. This is very important so that we
24 know who made the comment, and if we -- and who
25 we need to touch bases and have side discussions,

1 if needed, as we're developing Code language. So
2 if you don't, I will probably jump in and stop
3 you and have you state your name and your
4 affiliation and restate your question or comment.

5 So with that, I'm going to pass it on to
6 Haile.

7 MR. BUCANEG: Good morning everyone. Can
8 you guys see my screen?

9 MR. BOZORGCHAMI: Yes, Haile.

10 MR. BUCANEG: Okay. Perfect.

11 So, as Payam mentioned, my name is Haile
12 Bucaneg and I am a Senior Mechanical Engineer
13 with the Building Standards Office. This
14 morning, I will be discussing the Codes and
15 Standards Enhancement Initiative Nonresidential
16 Computer Room Efficiency Proposal.

17 Before I begin, I want to thank Hillary
18 Weitze, Neil Bulger, and Jeff Stein, who were the
19 primary authors for this proposal.

20 Oops. Let me see here. There you go.

21 Staff received proposals pertaining to
22 nonresidential computer room efficiencies. And
23 there are three measures that I would like to
24 present for the 2022 Energy Commission update.
25 These are increased temperature thresholds for

1 economizers, uninterruptable power supply
2 efficiency, and moving reheat, humidification,
3 and fan controls to mandatory requirements.
4 These proposed measures will affect Section
5 110.1(a), 140.9(a), and create a new Section
6 141.1(b).

7 The first measure I will discuss is the
8 increased temperature threshold. I'll be
9 discussing the specifics of the proposal and the
10 analysis of the proposal. And I will also be
11 discussing some of the exceptions included in the
12 measure proposal before touching upon the
13 estimated statewide savings.

14 Under the 2019 Energy Code, four
15 economizing requirements are dependent on whether
16 the economizer used is an air economizer or water
17 economizer. For air economizer, full economizing
18 is required at a dry bulb temperature of 55
19 degrees Fahrenheit and a wet bulb temperature of
20 50 degrees Fahrenheit. For water economizers,
21 the threshold is 40 degrees dry bulb and 35
22 degrees wet bulb.

23 Additionally, under current requirements,
24 air containment is required at a design load of
25 175 kilowatts per room.

1 This proposal would revise the
2 temperature threshold where full economizing
3 occurs to a dry bulb temperature of 65 degrees
4 and a wet bulb temperature of 50 degrees
5 Fahrenheit. These threshold would apply to any
6 type of economizer.

7 Additionally, the requirement for air
8 containment would be revised to an information
9 technology equipment design load of 10 kilowatts
10 per room, and that's an ITE design load.

11 These proposed requirements pertain to
12 new construction. Note that for existing
13 facilities the proposal allows for computer room
14 cooling systems to follow the 2019 temperature
15 threshold for economizers.

16 It should be noted that the revised
17 requirement for air containment of an ITE
18 designed load of 10 kilowatts per room would
19 still apply to existing facilities.

20 The revisions to the full economy
21 threshold is expected to have an affect on the
22 number of hours when full economizing and, also,
23 partial economizing is expected to occur. The
24 expected economizing hours under 2019 dry bulb
25 standards in blue and those under the proposed

1 dry bulb requirements in green can be seen here.
2 Since the proposed requirements for full
3 economizing was increased, the amount of time
4 when full economizing occurs also increased.
5 This table is based on increasing the dry bulb
6 temperature from 55 degrees to 65 degrees. And
7 this kind of represents the least amount of
8 increase in economizing hours.

9 A similar trend can be seen in comparing
10 expected economizing hours for wet bulb
11 temperatures. Here, we're looking at 35 degrees
12 to 55 degree increase in the temperature
13 threshold. And this represents a larger increase
14 in the number of economizing hours that would
15 occur.

16 Four prototypes were analyzed for this
17 measure. First was looking at a baseline
18 computer room air conditioner with an air
19 economizer. This prototype required the addition
20 of an air containment -- of air containment
21 equipment to meet the proposed requirement. The
22 cost for the addition for the air containment
23 equipment can be seen here. And this is per kW
24 ITE load.

25 Based on the cost incentive -- sorry.

1 The associated energy savings per
2 kilowatt ITE load are shown here. In addition to
3 increasing economizing hours, there were also
4 some energy benefits from increased efficiencies
5 for the direct-expansion air conditioner, and
6 this was due to higher return air temperatures
7 from the air containment system. Based on the
8 costs and benefits, we can see that this would be
9 cost effective in all climate zones.

10 A computer room air handler with chilled
11 water system and air economizer would represent
12 the best case scenario for this proposal from an
13 incremental cost standpoint. And this is because
14 no additional costs would be incurred when
15 meeting new proposed Code requirements.

16 This system would still realize energy
17 savings due to increased economizing hours.
18 These savings were a little bit less than the
19 first case proposal. But since there were no
20 additional costs, the benefit-to-cost for this
21 scenario were higher than those seen in the
22 direct-expansion air conditioner system.

23 The third prototype, based on a computer
24 room air handler with a water economizer, was
25 also reviewed. It was determined that to meet

1 the higher temperature threshold a larger heat
2 exchanger was required. Again, this is per ITE
3 design load kilowatt, so the larger the system
4 the higher the incremental costs. Again, the
5 savings here are based on increased economizing
6 hours and were estimated to be higher per
7 kilowatt ITE load than the previous two
8 scenarios.

9 Although this system did have increased
10 costs around the heat exchanger, the benefit-to-
11 cost ratio was still pretty significant because
12 that increased cost for the heat exchanger wasn't
13 too much compared to the energy savings.

14 Finally, a worst case scenario in terms
15 of additional costs is shown here. And this is
16 an existing system with a dry cooler being
17 changed to a water economizing system, yeah,
18 being changed to a water economizing system.
19 This included a number of additional incremental
20 costs which were estimated here. You can
21 actually see that the cost for the air-cooled
22 chiller actually went down. And that's because
23 it no longer has to provide economizing.
24 However, there were significant increases in
25 costs associated around the cooling tower and

1 heat exchanger.

2 While there are significant incremental
3 costs for this prototype -- oh, I'm sorry.

4 The proposed system did have energy
5 savings based on increase economizing hours. And
6 similarly, it wasn't as much as in the third case
7 scenario but it was more than in the first two
8 scenarios that were looked at.

9 While there are significant incremental
10 costs for this prototype, the benefit-to-cost
11 ratio was still found to exceed 1.0 in all
12 climate zones. Of the four scenarios analyzed,
13 this represented the least cost effective, and
14 this was just due to the high incremental costs.
15 And, also, in this analysis there were increased
16 costs associated with increased water usage for
17 this system.

18 There were several exceptions included as
19 part of this proposal. The first two exceptions
20 regarding small computer rooms and computer rooms
21 with a secondary fan system are based on existing
22 exceptions with just some minor adjustments. In
23 the case of the small computer rooms, the 18
24 kilowatt ITE design load threshold was
25 identified. And in the case of the computer

1 rooms with a secondary fan system the 70 kilowatt
2 ITE design load was identified. And, also, the
3 economizer, the last bullet here, which is the
4 economizer, can meet the computer room ITE design
5 load, or 5 tons plus 25 percent of economizing
6 capacity at design conditions was added in.

7 An exception was included for areas where
8 local water authorities do not allow for cooling
9 towers. In this case, we were allowing for 2019
10 requirements around the economizer.

11 And, finally, an exception was included
12 in computer room fan systems if computer room fan
13 systems do not exceed 0.35 watts per CFM and the
14 differential of supply air, and return air is at
15 least 25 degrees, and cooling system efficiencies
16 are 20 percent better than Table 110.2(a) through
17 110.2(k), or Title 20, Table C-7. If all of
18 these conditions are met, again, we would allow
19 for -- or the proposal allows for 2019 threshold
20 to be used.

21 Overall, this measure is expected to
22 result in 215 gigawatt hours in electricity
23 savings and \$514 million over the 15-year
24 analysis period.

25 For additions and alterations, the only

1 savings here are associated with revised air
2 containment requirements which were relatively
3 minor. As you recall, for additions and
4 alterations, they would not -- they would be able
5 to meet the 2019, the current, threshold in
6 regards to economizing temperatures.

7 A reduction of approximately 51,600
8 metric tons in greenhouse gases is expected with
9 this measure. And this is due to the high number
10 of operating hours of cooling systems servicing
11 computer rooms which run 24/7.

12 So as mentioned, this measure is cost
13 effective in all climate zones. There were a
14 number of exceptions included to allow for
15 flexibility in various scenarios. And this
16 measure is no longer based on air and water
17 economizers. Only as long as the temperature
18 threshold can be met, any type of economizer
19 would be allowed.

20 With that, we can take questions. You
21 can type questions into the Q&A box, or you can
22 go ahead and raise your hand and we can un-mute
23 you.

24 MR. BOZORGCHAMI: Haile, we have one
25 raised hand.

1 Laura, I'm going to un-mute you.

2 MS. PETRILLO-GROH: Hello. This is Laura
3 Petrillo-Groh with the Air Conditioning, Heating,
4 and Refrigeration Institute. Can you hear me
5 okay?

6 MR. BOZORGCHAMI: Perfect. Go ahead.

7 MS. PETRILLO-GROH: Yeah. Thanks Brian.
8 Thanks Haile.

9 So for the benefit of the record, the Air
10 Conditioning, Heating, and Refrigeration
11 Institute represents over 320 manufacturers of
12 air conditioning, heating, ventilating, water
13 heating, and commercial refrigeration products.
14 We appreciate the work that the Case Team has
15 done to date. The process was -- we were very,
16 very engaged with the process and it included us
17 as stakeholders. And we've seen some pretty
18 significant improvement in the readability,
19 understandability, and general enforceability of
20 the draft proposal. So, you know, thanks to the
21 Case Team for that hard work at the beginning.

22 I do have three questions that I'd like
23 to raise here, if that's okay?

24 MR. BOZORGCHAMI: Please. Go ahead.
25 Sure.

1 MS. PETRILLO-GROH: Okay. Thank you.

2 So, you know, appreciate that the --
3 where the proposal clearly includes refrigerant
4 economizers. However, it looks like, in the Case
5 Report, only one manufacturer was cited to meet
6 the temperature, the new higher temperature
7 threshold requirements.

8 You know, have other manufacturers been
9 approached for data? Or, you know, we, I think,
10 the public and design engineers need to be
11 confident that the proposal will not limit the
12 technology options of the manufacturers that are
13 allowed to compete in the California marketplace.
14 So can you talk about any other manufacturers'
15 products that are able to meet those increased
16 temperature thresholds for refrigerant
17 economizers?

18 MR. BOZORGCHAMI: Haile?

19 We lost Haile. He's trying to come back
20 on. I apologize.

21 MS. PETRILLO-GROH: Okay. Well, I barely
22 got to make a comment without a baby screaming in
23 the background, so this new reality is certainly
24 challenging.

25 MR. BUCANEG: I'm sorry about that. I

1 did get dropped off the call. I'm back on now.
2 This is Haile Bucaneg with the Energy Commission.

3 MS. PETRILLO-GROH: Hi Haile. Did you
4 catch my question or would like me to repeat?

5 MR. BUCANEG: I caught the beginning of
6 the question regarding one identified refrigerant
7 system that would meet the requirements. That is
8 a question that we have as well. At the end of
9 the presentation, I was going to be bring up a
10 question, just asking for additional input
11 regarding whether or not additional technology
12 meet this revised temperature threshold and
13 getting public input around that.

14 MS. PETRILLO-GROH: Okay. Thanks.

15 MR. BUCANEG: I believe Hillary is on the
16 call as well. I'm not sure if she would like to
17 speak to this as well. I can ask if she would
18 like to un-mute herself here?

19 MR. WITTERS: Sure. Thanks Haile.

20 Yeah, I think that's a good question, if
21 you wanted to bring that up at the end. I guess,
22 maybe, two comments I will bring up.

23 One is we were able to get some data,
24 just in terms of market share of different
25 economizer types in California, that was added

1 into the Final Case Report. And based on the
2 data that we received it did look like only about
3 13 -- 10 to 15 percent of computer rooms were
4 served by refrigerant economizers. And that
5 includes both -- we were not able to disaggregate
6 between new construction and existing computer
7 rooms. So based on -- we don't have hard
8 numbers, but based on discussions with
9 stakeholders, design engineers, the feedback we
10 got is that the majority or a good, at least, you
11 know, more than half of the refrigerant
12 economizers are being installed in existing
13 computer rooms or computer rooms in existing
14 buildings, which would not be subject to the new
15 higher economizer threshold in the proposal.

16 MS. PETRILLO-GROH: Thanks for that
17 background, Hillary. Yeah, we do want to be sure
18 that the Code is open and doesn't end up
19 inadvertently mandating proprietary technology.
20 So AHRI can certainly look into, you know, which
21 technologies can meet this and try to provide you
22 some additional information by the 7th. Noting
23 that about 50 percent of the products are in
24 existing construction, that, to me, I think would
25 mean that there is a desire to install

1 refrigerant economizers in California.

2 Overall, I think the, you know, the rule
3 of thumb is that, you know, about 80 percent of
4 products go into existing construction and 20
5 percent into new buildings. So that's, you know,
6 a different breakout, 50/50 is certainly a
7 different breakout than the 80/20. So I would
8 hope that we could make sure that other
9 manufacturers would have the opportunity to
10 compete in the state of California.

11 MS. WEITZE: Sorry. Can I just clarify?
12 The more than 50 percent, that definitely is not
13 a hard number. I think I was, basically, trying
14 to -- well, the 80/20 is good information and we
15 did not have that specific of a number. I think
16 my comment was mostly just to say, our
17 understanding is that the majority of refrigerant
18 economizers are going into existing, which, I
19 think, is what you just kind of supported. So I
20 just, I want to be careful. The 50 percent was
21 not a specific number that we have.

22 MS. PETRILLO-GROH: Okay.

23 MS. WEITZE: Yeah. Yeah. Thank you.

24 MS. PETRILLO-GROH: Sure. Yeah, just a
25 general rule of thumb.

1 So my next question is really about just
2 trying to seek clarification where you've got
3 water economizers with evaporative cooling towers
4 and air economizers in the Case Report. That, to
5 me, it seems that, you know, any system with a
6 water-cooled economizer to meet the full
7 requirements about running in economizer mode and
8 that the load on the chillers is below the design
9 requirement in full economizer mode, this, to me,
10 is that the redundant equipment that might be
11 installed, and is typically installed in the
12 mission-critical space, would need to be
13 operating during standard economizer mode. Is
14 that the correct interpretation of this proposal
15 as written or is it just the -- can you, perhaps,
16 speak to that?

17 MR. BUCANEG: I didn't really understand
18 the question. Can you restate it? Sorry.

19 MS. PETRILLO-GROH: Sure. So in the Case
20 Report, it states that -- you know, it's the
21 importance of recognizing that redundant
22 equipment should be running in economizer mode,
23 and that the load on the cooling tower should be
24 below the design load in full economizer mode,
25 making it easy to achieve full economizing at 50

1 degrees wet bulb.

2 So I'm wondering if the backup equipment
3 needs to be running during full economizing, if
4 that's what the language is suggesting? Is that
5 the correct interpretation?

6 MR. BUCANEG: Hillary, do you want to
7 speak to that one? I don't think that I can
8 answer that specifically.

9 MS. WEITZE: Sure. Yeah. No, it is not
10 required that the backup equipment is running to
11 meet the elevated temperatures. You could select
12 cooling towers that are designed for the elevated
13 temperatures without having to, you know, to run
14 additional towers and parallel at a lower load
15 factor.

16 So that was suggested in the Case Report
17 as, perhaps, a more -- you know, the sort of most
18 efficient way to achieve the proposed elevated
19 temperatures but it is -- it wouldn't be
20 required. You could select towers at, you
21 know -- to -- you know, whether or not you
22 want -- you could decide whether you wanted to,
23 you know, run everything in parallel at that peak
24 condition or at the peak economizing condition or
25 just select your towers and just run the non-

1 redundant equipment.

2 MS. PETRILLO-GROH: Okay. Thank you so
3 much for clarifying. We might make comments
4 around suggesting an improvement to reflect that
5 intention. It was confusing as we had read it.

6 And then the last question I had was on
7 the, you know, the refrigerant economizers that
8 are going to be permitted to -- in the Additions
9 and Alterations section. I noticed that there are
10 certain individual climate zones that -- where
11 this is permitted, but I didn't see that there
12 was any justification for that. Could you maybe
13 speak a little bit about the limitations in those
14 climate zones?

15 MR. BUCANEG: So the economizer portion
16 that was discussed and proposed, that is based on
17 what is allowed prescriptively in the Energy Code
18 right now. So that was what that proposal was
19 based around.

20 MS. PETRILLO-GROH: So there is a
21 limitation in the climate zones where that is
22 permitted, where refrigerant economizer has been
23 shown to be more efficient than the baseline
24 water economizers?

25 MR. BUCANEG: Let me get back to you on

1 that one because I know that we have some
2 additional questions around that. So let me make
3 sure that I get you the correct answer on that
4 one.

5 MS. PETRILLO-GROH: Okay. Thank you so
6 much. Again, I appreciate all the time that has
7 gone into developing this proposal.

8 It would be very helpful if, maybe,
9 meeting materials could be made available in
10 advance of these presentations. And if I missed
11 something posted to the docket, my apologies. I
12 did check right before. So being able to see the
13 slides and follow along with you would be very
14 helpful. The slides were not numbered.

15 And also, you know, as much time as we
16 can get to develop comments; the analysis was
17 quite robust and it requires a lot of time to go
18 through these in detail.

19 So thanks again. That's all I have for
20 now.

21 MR. BUCANEG: Okay. Thank you. And the
22 slides aren't available at this time. They
23 usually go up after the presentation. So, yeah,
24 that's just kind of to say, you did not miss
25 anything on the docket for the presentation

1 slides yet.

2 MR. BOZORGCHAMI: Thanks Laura.

3 Any other questions? Comments?

4 With that, Haile, do you want to move on?

5 MR. BUCANEG: Sure. Okay, so the second
6 measure I want to discuss is the uninterruptible
7 power supply efficiency measure. This measure
8 requires minimum energy efficiencies for UPSs
9 based on the type and size. The testing
10 procedures are based on the ENERGY STAR Program
11 requirement -- oh, sorry, I haven't advanced the
12 slide yet. This measure requires minimum energy
13 efficiencies for UPSs based on the type and size.
14 The testing procedures are based on the ENERGY
15 STAR Program requirements for Uninterruptible
16 Power Supplies Eligibility Criteria Version 2.0.
17 This proposal does include some exceptions based
18 on the input plug type for the UPS, and those are
19 shown here.

20 This table is from the ENERGY STAR
21 Program and shows the minimum efficiencies for
22 UPSs -- or shows how the minimum efficiencies for
23 UPSs are calculated. In several cases a specific
24 minimum efficiency is identified. But in other
25 cases, this minimum efficiency is going to need

1 to be calculated out.

2 As mentioned, efficiencies will be --
3 will also be dependent on if the UPS is voltage
4 and frequency independent, voltage independent,
5 or voltage and frequency independent.

6 Two prototypes were analyzed for this
7 proposal, this measure. The first was a direct-
8 expansion computer room air conditioner unit
9 servicing a 200 kilowatt ITE load. And the
10 second was a chilled water computer room air
11 handler servicing a 1,000 kilowatt ITE load. The
12 incremental cost associated with the higher
13 efficiency UPS measure are shown here for both
14 prototypes. And the incremental cost was based
15 on the equipment cost, increases in equipment
16 costs as labor, controls, and commissioning were
17 all expected to be the same.

18 The savings for the first computer room
19 air conditioner prototype here were based on a
20 combination of higher UPS efficiencies and some
21 cooling savings. The savings were relatively
22 consistent across all climate zones.

23 The source of savings for the computer
24 room air handler were also the reduced
25 electricity usage from the UPS and for cooling.

1 And with the larger system, you can see that
2 there was a little bit more variation in savings
3 between climate zones shown here. And, again,
4 this is per kW ITE mode.

5 Both the prototypes show the benefit cost
6 above 1.0 in all climate zones, which can be seen
7 here for the 200 kilowatt ITE computer room
8 served by the direct-expansion air conditioner.
9 And here, for the 1,000 kilowatt ITE computer
10 room certified air handler. And, again, these
11 savings are per kilowatt ITE mode.

12 Overall, this measure is expected to save
13 137 gigawatt hours of electricity and \$335
14 million over the 15-year analysis. And this
15 would be across new construction and additions
16 and alterations. This would represent greenhouse
17 gas reductions of approximately 32,900 metric
18 tons.

19 This measure did show cost effectiveness
20 over all climate zones. And this measure reduces
21 energy usage over 24 hours and, additionally,
22 does reduce cooling loads. The exceptions
23 included are based on UPS devices which are
24 federally regulated, so we're just kind of
25 avoiding those.

1 And then that's it for the UPS, the
2 Uninterruptible Power Supply Efficiency Measure
3 proposal. Do we want to take some quick questions
4 on this measure proposal?

5 MR. BOZORGCHAMI: Okay, Haile, I don't
6 see any raised hands or any questions in the
7 question and answer box.

8 MR. BUCANEG: Okay. Sounds good. The
9 next proposal discussion is going to be very
10 short as well. And after that, we can take
11 questions on the proposal, as well, or on the --

12 MR. BOZORGCHAMI: Sure.

13 MR. BUCANEG: -- all the measure
14 proposals. So --

15 MR. BOZORGCHAMI: Sure.

16 MR. BUCANEG: -- so, finally, I'd like to
17 discuss a few proposed mandatory requirements for
18 computer rooms. The new requirements pertaining
19 to reheating, humidification, and fan controls
20 are currently prescriptive requirements. The
21 proposals would be move to -- the proposal would
22 move requirements preventing reheating,
23 recooling, and simultaneous heating and cooling
24 to the same zone, and also adiabatic
25 humidification to mandatory requirements.

1 Additionally, there will be a mandatory
2 requirement for fan controls, for air
3 conditioners exceeding 60,000 Btus per hour, and
4 each chilled water fan system to vary the air
5 flow rate as a function of actual load and have
6 controls or devices that will result in fan power
7 demand of no more than 50 percent of design
8 wattage at 66 percent of design fan speed. So,
9 again, this is just taking the language that is
10 prescriptive requirements and moving this into
11 mandatory requirements.

12 And then, again, before taking questions
13 on this portion of the proposal, or any other
14 portion of the proposal measures discussed, I did
15 want to bring the one item that we would like to
16 get public input on. This was touched upon
17 earlier but it was determined that air and water
18 economizers would be able to meet the revised
19 temperature thresholds. And the Case Team also
20 identified an example of a refrigerant economizer
21 that could meet threshold. But I'd like to get
22 the public's input on the feasibility of using
23 various economizer technologies at these
24 temperature thresholds.

25 So if you guys have any information on

1 that, feel free to submit that to the -- submit
2 it to our docket and we can take that into
3 consideration as well.

4 And, again, if you have any questions,
5 not just on this portion of the -- or this
6 measure but on anything that was presented, we
7 can discuss that now.

8 MR. BOZORGCHAMI: Haile, I don't see any
9 raised hands, so --

10 MR. BUCANEG: Okay.

11 MR. BOZORGCHAMI: -- I'm assuming folks
12 are going to be submitting comments to the
13 comment -- to the docket by October 7th, so --

14 MR. BUCANEG: Okay. Perfect. So the
15 link here, again, as I mentioned, if you have any
16 comments or think of any additional questions or
17 comments in the future, you can submit them here
18 by October 7th, 2020.

19 You can also reach out to me regarding
20 comments. So if you can reach out to me regarding
21 the refrigeration -- refrigerant economizer
22 comment, wherein I can also get back to you on
23 that, just so it would be easier for me to get
24 your contact information? If you send me an
25 email, I can follow up on that one, make sure I

1 get back to you on that question.

2 Again, Payam is the overall Project
3 Manager on 2022. And Larry is leading the
4 revisions on energy modeling softwares.

5 And that's it for the Case Report -- the
6 Case proposal regarding computer room
7 efficiencies. And I think we'll be handling --
8 handing it off to Ronald for the next question,
9 the next presentation questions.

10 MR. BALNEG: Yeah. Hi. Hey, Payam, can
11 you move to host? I can't share my screen. I
12 guess I'm considered a participant right now.

13 MR. BOZORGCHAMI: Oh. Sorry about that.
14 Let me -- give me one second.

15 MR. BALNEG: Yeah. That was my fault.
16 My internet disconnected for quite a bit this
17 morning. I just got it back on. I apologize.
18 There you go.

19 MR. BOZORGCHAMI: So, Ronald, you're now
20 a co-host also. So, Ronald, we can see your
21 screen.

22 MR. BALNEG: Okay. Can you guys hear me?

23 MR. BOZORGCHAMI: Yes.

24 MR. BALNEG: Okay. So I'm going to be
25 talking about the Nonresidential Integrated

1 Pumped Refrigerant Economizer Proposal.

2 This proposal was submitted to the Energy
3 Commission by Vertiv. The is a company that
4 manufacturers pump refrigerant economizers for
5 computer rooms. This proposal seeks to add
6 integrated pump refrigerant economizers to the
7 section as a prescriptive, along with air and
8 waterside economizers.

9 So here are the affected sections. A
10 definition will be added for pump refrigerant
11 economizers, and a prescriptive requirement for
12 Section 140.9(a)(1). They have also proposed to
13 model refrigerant economizers equivalent to
14 airside and water economizers, considering this
15 is a prescriptive requirement.

16 So here are the existing requirements.
17 As mentioned earlier, for air and water
18 economizers in Section 140.9(a)(1), currently,
19 pump refrigerant economizers are a compliance
20 option as an alternative pathway to comply with
21 this economizer requirement section.

22 So in this slide, this is the proposed
23 addition of the definition, as well as the
24 prescriptive requirements.

25 So what is a pump refrigerant economizer?

1 So here is an example of a system.
2 During the economizer mode, compressors are
3 turned off and the refrigerant pump moves
4 refrigerant through the circuits for economizing.
5 In partial economizing mode, one circuit will
6 operate the compressor while others will -- while
7 the other circuit will operate the refrigerant
8 pump. And so this was taken out of the Staff
9 Report for the compliance option.

10 And here is the integrated refrigerant
11 pump. This is where the refrigerant pump is
12 integrated within the unit where it eliminates an
13 added footprint.

14 So modeling assumptions. The modeling
15 assumptions include a 14,000 square foot data
16 center with 85 watts per square foot. The same
17 low profile was added to all climate zones. And
18 the energy savings were compared to a waterside
19 economizer that minimally complies with the
20 current 2019 Code.

21 And so here are the energy savings from
22 the modeling. You can see the peak electricity
23 demands and the TDV savings for each climate
24 zone.

25 So this proposal assumes an incremental

1 cost of zero dollars compared to chilled-water
2 equipment. So here's a real-world example that
3 was taken from Vertiv's report. And independent
4 contractor did cost estimates for 200 tons of
5 cooling. You can see the price differences in
6 the initial costs and difference in maintenance
7 costs per year between a pump refrigerant system
8 and a chilled-water system.

9 And so for the cost-benefit ratio, the
10 cost-benefit ratio is greater than one for all
11 climate zones. With an incremental cost of zero,
12 any amount of energy savings would cause the
13 cost-benefit ratio to be infinite.

14 So pump refrigerant economizers have been
15 installed and operating for the past six years.
16 It's estimated these systems are estimated to
17 save 4.3 million gallons of water annually. And
18 this proposal shows it's cost effective in all
19 climate zones.

20 So some Staff questions that I had, that
21 I would like to get some input on from the
22 public, is are the incremental cost assumptions
23 compared to waterside -- sorry, that shouldn't
24 say economizer, it should be system -- waterside
25 system, are they accurate to assume a zero dollar

1 incremental cost?

2 Should the term "integrated" be included
3 in the prescriptive requirement? In other parts
4 of the Code we have the term "integrated" but
5 it's used differently. Or would this limit other
6 methods of this type of economizer?

7 Other stakeholders, in the previous Case
8 Report, they pushed to change the term
9 "refrigerant" to "fluid" for another proposal
10 regarding refrigerant economizers. Should this
11 term -- should the term, "without using any
12 water" be removed? And should we change
13 "refrigerant" to "fluid," the term "fluid?"

14 And should these -- should the style of
15 economizer be modeled equivalent to an airside
16 and waterside economizers?

17 And so with that, I'll take any
18 questions.

19 MR. BOZORGCHAMI: Hey, Ronald, this is
20 Payam. We have one question from Mr. Jim Marsh,
21 and his question is, "Following the spirit of law
22 from AHRI," this is his question, "are there any
23 vendors of integrated pump refrigerant
24 economizers in the marketplace, other than
25 Vertiv?"

1 MR. BALNEG: That is a good question. I
2 am not familiar with other economizers. I guess
3 Laura can -- she's raising her hand. Maybe she,
4 ARHI, might have more information on that.

5 MR. BOZORGCHAMI: Is this a question that
6 Lisa may be able to answer?

7 MR. BALNEG: Yeah, possibly.

8 Lisa, are you there?

9 MS. SAPONARO: Yes, I am. This is Lisa
10 Saponaro from Vertiv.

11 So I can speak to the specific technology
12 that we use as something that Vertiv has. There
13 are other manufacturers of refrigerant-style
14 economizers but they may not be exactly the, you
15 know, same exact technology.

16 MR. BOZORGCHAMI: So there's -- sorry,
17 you broke up a little bit. So there are other
18 manufacturers but just, pretty much, maybe not
19 the same type of technology; is that what you
20 were saying? I apologize. This is Payam again.

21 MS. SAPONARO: That's okay, Payam. Can
22 you hear me now?

23 MR. BOZORGCHAMI: Yeah. Yeah.

24 MS. SAPONARO: Okay. Maybe it's my end.

25 So there are other manufacturers of

1 refrigerants economizers, period.

2 MR. BOZORGCHAMI: Okay. Wonderful.

3 MS. SAPONARO: Yes.

4 MR. BOZORGCHAMI: Okay.

5 MS. SAPONARO: Um-hmm.

6 MR. BOZORGCHAMI: Thank you.

7 Laura, I'm going to un-mute you again.

8 Please state your name and affiliation again.

9 Thank you.

10 MS. PETRILLO-GROH: Hi. This is Laura
11 Petrillo-Groh with Air Conditioning, Heating, and
12 Refrigeration Institute.

13 Yeah, we absolutely support any proposal
14 that allows manufacturers of different products
15 to compete fairly in the California market, and
16 any proposal that is not excluding competitive
17 product types, so I think that will be the one
18 differentiation. I'm trying to make sure that
19 proposals allow for multiple product types, as I
20 was concerned about the temperature requirements.
21 And, you know, anything that allows newer and
22 more innovative products, not at the detriment of
23 any other products to be -- to participate in
24 California is -- it would be an option for
25 California designers.

1 MR. BOZORGCHAMI: Wonderful.

2 MS. PETRILLO-GROH: Thank you.

3 MR. BOZORGCHAMI: Thank you, Laura.

4 Jon McHugh, I'm going to un-mute you,
5 sir.

6 MR. MCHUGH: Can you hear me?

7 MR. BOZORGCHAMI: Yes. How are you?

8 MR. MCHUGH: Yeah. I actually have a
9 question about this. And I know this came up
10 earlier with the performance approach, which is
11 when thinking about what the base case should be,
12 you know, there's lower hours of economizing when
13 you use a waterside economizer. But, to some
14 extent, that is made up for the fact that water-
15 cooled equipment has a substantially higher CoP
16 than air-cooled equipment. And it seems to me
17 that, you know, the refrigerant economizer, in
18 general, it's serving air-cooled equipment. And
19 as a result, from my point of view, it seems like
20 you would want to compare that to an airside
21 economizer, you know, with the more hours of
22 cooling because that airside economizer with more
23 hours of cooling helps partially offset the fact
24 that the airside -- or I'm sorry, the air-cooled
25 equipment is so much less efficient.

1 So, hopefully, that's, you know, I think
2 raising the question that was brought up during
3 the pump refrigerant economizers.

4 MR. BOZORGCHAMI: So this is Payam again.

5 Jon, so you're saying that the comparison
6 should have been compared to airside versus
7 waterside?

8 MR. MCHUGH: Right, because the --

9 MR. BOZORGCHAMI: Sure.

10 MR. MCHUGH: -- because the air-cooled
11 equipment is less efficient, you know, when it's
12 actually operating in the mechanical cooling
13 mode.

14 MR. BOZORGCHAMI: Okay. Thank you.

15 MR. MCHUGH: Thank you.

16 MR. BOZORGCHAMI: That's a good point.

17 Excuse me.

18 Any other comments or questions?

19 With that, Ron, do you want to move on to
20 your next slide?

21 MR. BALNEG: Yeah. Sure.

22 MR. BOZORGCHAMI: Yeah.

23 MR. BALNEG: I'm sorry.

24 MR. BOZORGCHAMI: So, yeah, Ron will jump
25 through those loops real quick, but there he had

1 two slides, one on, again, comments on this
2 proposal, please by October 7th. And I
3 apologize. You're going to see a lot of that
4 coming up, and contact information. I'm just
5 trying to emphasize, we need your comments sooner
6 than later, so you'll see a few of these slides
7 over and over and over again.

8 MR. BALNEG: Yeah. Sorry about that. I
9 don't know what happened to my screen share. It
10 just ended.

11 MR. BOZORGCHAMI: Don't worry. You're
12 all -- you're good. You're good.

13 MR. BALNEG: Okay. Thanks everyone.

14 MR. BOZORGCHAMI: So with that, I think,
15 we're going back to Haile, who is going to do his
16 presentation, I believe, on pipe sizing and
17 monitoring of compressed air systems.

18 MR. BUCANEG: Good morning, again,
19 everyone. Yeah, I'm un-muted. Okay. Great.
20 Good morning, again, everyone. Again, this is
21 Haile Bucaneg with the Building Standards Office.

22 Moving on from computer rooms, I'll now
23 be discussing the Codes and Standard Enhancement
24 Initiative for Pipe Sizing, Monitoring, and Leak
25 Testing for Compressed Air Systems Proposal.

1 Before I begin, I would like to thank M M
2 Valmiki, Val, Joseph Ling, Keith Valenzuela,
3 Regina Kahlua (phonetic), and Teri Cokley
4 (phonetic), who were the primary authors of this
5 proposal.

6 Staff received proposals for measures
7 pertaining to compressed air systems. And three
8 proposed measures I would like to present for the
9 2020 Code update process focus on pipe sizing
10 requirements for compressed air systems, leak
11 testing requirements for compressed air systems,
12 and compressed air system monitoring.

13 In the current 2019 Energy Code, the
14 Compressed Air System Requirements are located in
15 Section 120.6(e). This will also be where the
16 proposed Code changes will reside. Additionally,
17 there are proposed Code changes to reference
18 Appendix NA7.13.

19 So, first, I will start off discussing
20 the Pipe Sizing Measure Proposal, including pipe
21 size design requirements and the energy savings
22 associated with this measure.

23 This measure provides several
24 requirements associated with compressed air
25 system piping. First, compressed air piping

1 greater than 50 adjoining feet in length. For
2 that type of piping, service line piping must
3 have an inner diameter of three-quarter inch or
4 greater. And service line piping is just the
5 piping that delivers compressed air from
6 distribution piping to the end uses.

7 For compressed air piping greater than 50
8 adjoining feet in length, one of the following
9 requirements must also be met.

10 The first option is to design the
11 compressed air piping based on piping section
12 velocity where the maximum air velocity in the
13 compressor room interconnection and main header
14 piping does not exceed 20 feet per second and,
15 also, the average velocity in distribution and
16 service piping is 30 feet per second or less.

17 The second option is to design compressed
18 air piping based on total pressure drop where the
19 frictional pressure loss is less than five
20 percent of design operating pressure between the
21 compressor and end use or end use regulator.

22 So to analyze energy savings, four
23 prototype compressed air systems were used.
24 These systems represent various compressed air
25 system sizes. The appropriate compressed air

1 pipe sizing for these systems was determined
2 based on total pressure drop of the system. Once
3 the optimal pipe sizing was determined based on
4 five percent pressure drop, the system was
5 modeled using the appropriate readily-available
6 pipe size. And, typically, in most cases, that
7 readily-available pipe size was a little bit
8 larger than the optimal pipe sizing that was
9 capsulated.

10 So the difference in pressure drop
11 between the baseline compressed air system and
12 the system with the compressed air pipes based on
13 the proposed pressure drop requirement can be
14 seen here. In all cases the proposed system had
15 a pressure loss lower than the five percent
16 requirement which, in this case, was 5 psig as
17 the design suggestion was 100 psig.

18 The energy savings associated with this
19 measure can be seen here. And these energy
20 savings are based on load profiles for each
21 prototype over a year period.

22 The material costs and labor costs for
23 the installation of piping is shown here. The
24 material costs were based on aluminum pipes,
25 which is generally cheaper than steel welded

1 pipes. But the Case Team did reach out and found
2 that more and more compressed air systems are
3 being designed with aluminum piping. So this
4 represents a slightly conservative cost for the
5 piping equipment.

6 Labor costs were based on the labor cost
7 rates associated with installing steel welded
8 pipes since those labor cost rates were more
9 readily available. Installing aluminum pipes,
10 the labor rate for that would be a little bit
11 less. So, again, a higher cost was used. A
12 higher than typical cost was used for the labor
13 rates here.

14 So based on the associated costs and
15 savings, the benefit-to-cost ratio was shown to
16 exceed 1.0 for all four prototypes.

17 Looking statewide, the pipe sizing
18 requirements -- requirement measure is expected
19 to result in 13.6 gigawatt hours of electricity
20 savings in the first year, and a reduction in
21 3,275 metric tons of greenhouse gases. Over the
22 15-year analysis period, cost saving is estimated
23 at \$34 million.

24 The pipe sizing measure would be
25 effective in all climate zones. And this measure

1 also helps to standardize best practices for
2 compressed air pipe design and the velocity and
3 pressure drop design options were provided for
4 flexibility in meeting this requirement.

5 So are there any questions? We can stop
6 and take questions for the first measure proposal
7 pertaining to compressed air. Are there? If you
8 have any questions, please raise your hand, or
9 you can type them into the Q&A.

10 MR. BOZORGCHAMI: Any questions?
11 Concerns?

12 MR. BUCANEG: And, again, if you do think
13 of questions after the fact, you can always
14 submit it to our docket, as well, and you'll see
15 that when it comes up at the end of the
16 presentation again.

17 MR. BOZORGCHAMI: Haile, go ahead and
18 move on.

19 MR. BUCANEG: Okay.

20 MR. BOZORGCHAMI: Folks, and I you feel
21 uncomfortable submitting them to the docket, you
22 can always communicate directly with Haile, and
23 he will answer your questions also.

24 Oh, we've got one question that came up
25 from Beth. "How does this compare to the

1 Plumbing Code?"

2 MR. BUCANEG: For this, I'm not sure how
3 this would compare to the Plumbing Code. I
4 didn't really think about that. Yeah. I would
5 have to look that up.

6 I think we have Val on the line. I'm not
7 sure if he would have any insight into that.
8 Val. Let me here if I can find him.

9 MR. VALMIKI: Yeah. Hi. I'm here. Can
10 you hear me?

11 MR. BUCANEG: Yes. Now we can hear you.

12 MR. BOZORGCHAMI: Yeah.

13 MR. VALMIKI: Yeah. Hi. This is Valmiki
14 with (indiscernible).

15 So the Plumbing Code doesn't have
16 specific requirements for compressed air piping
17 that we are aware of, except in the case of
18 healthcare and hospitals. And those were a bit
19 more safety related, and would take precedence in
20 that regard, and are more than sufficient to
21 achieve the energy requirements regardless. So,
22 as far as we've seen, there's not any conflict or
23 significant overlap with what we're proposing.

24 MR. BOZORGCHAMI: Thank you, Val.

25 MR. VALMIKI: Yeah.

1 MR. BOZORGCHAMI: So with no other
2 questions or comments, I don't see any raised
3 hands, so go ahead, Haile.

4 MR. BUCANEG: Okay. So the second
5 measure I wanted to discuss for this -- from this
6 proposal is leak testing for compressed air
7 piping. This measure proposes testing
8 requirements for new compressed air piping
9 greater than 50 adjoining feet and, also,
10 different testing requirements for new compressed
11 air piping for 50 feet or less.

12 So, first, for new compressed air piping
13 greater than 50 adjoining feet, pressure testing
14 at design pressure is reqd. if necessary, the
15 compressed air piping being tested can be
16 isolated from supply air and end uses. The new
17 compressed air piping must hold pressure for the
18 length of time identified by the authority having
19 jurisdiction but not less than 30 minutes.

20 For new compressed air piping for 50 feet
21 or less, leak testing is required. The system
22 must first be pressurized, then connections must
23 be tested using leak detecting fluid or other
24 leak detecting methods at the discretion of the
25 authority having jurisdiction.

1 So the same four prototypes -- prototype
2 systems were used to estimate savings associated
3 with these testing. Here you can see the annual
4 energy savings associated with reducing system
5 leakage by two percent.

6 And then the costs associated with leak
7 testing are shown here. The labor costs were
8 based on pipefitter rates. And it is assumed
9 that the installer of the compressed air piping
10 will be performing the leak tests as well.

11 Based on the cost and saving associated
12 with leak testing, the benefits-cost ratio for
13 all four of our prototype systems exceeded 1.0.
14 Please note that these costs here and the
15 benefit-to-cost ratio are slightly different from
16 what is included in Table 42 of the report. There
17 was a slight calculation in putting in the labor
18 rates in the report. So the corrected numbers
19 are shown here.

20 So over the first year, this measure is
21 expected to save 1.4 gigawatt hours in
22 electricity and reduce greenhouse gas emissions
23 by 339 metric tons. Over the 15-year period of
24 analysis, \$3.5 million in energy cost savings is
25 expected.

1 Again, this measure is expected to apply
2 to all climate zones and be effective in all
3 climate zones. Again, this will standardize
4 another best practice procedure for compressed
5 air. And it should be noted that the testing
6 procedures here are based on testing of natural
7 gas systems.

8 So are there any questions regarding the
9 leak testing measure proposal?

10 MR. BOZORGCHAMI: Haile, I don't see any
11 raised hand or any questions in the question box.

12 MR. BUCANEG: Okay. So the final -- the
13 last measure I want to discuss is a proposed
14 measure for compressed air system monitoring.

15 So these requirements would apply to all
16 new compressed air systems, and also additions
17 with capacities of 100 horsepower or greater. In
18 these cases, a compressed air monitoring system,
19 which can measure system pressure, amps of power
20 of each compressor, airflow of each compressor,
21 and provide data logging of pressure, power,
22 airflow, and compressed air specific power at
23 intervals of five minutes or less are required.

24 Additionally, data must be stored for at
25 least 24 months. And a visual trend display --

1 trending display of each recorded point will also
2 be required.

3 There are several testing requirements
4 associated with this measure.

5 First, it must be verified and documented
6 that the compressed air monitoring system meets
7 the identified monitoring requirements during
8 construction inspection. And these are all of
9 the requirements that would be required for the
10 monitoring system to monitor, and also display.

11 And second, a functional test must be
12 performed where the data observed during testing
13 is being recorded to a log file that can be
14 opened and reviewed to see trend or airflow,
15 power, and specific efficiency in intervals of
16 five minutes or less, and also airflow and
17 compressor data vary -- with loading and
18 unloading of the compressor within typical
19 performance expectations. All measures should be
20 observed across various loading, whether
21 manually, varied, or in response to actual
22 operational loads.

23 Before prototype systems were analyzed
24 assuming that the monitoring system reduced
25 compressed air leakage by eight percent, so if

1 you take into account both the leak testing and,
2 also, this monitoring, that would be a total leak
3 reduction of ten percent on a compressed air
4 system.

5 There were several costs associated with
6 compressed air system monitoring. This included
7 both single-time equipment costs and labor costs,
8 as well as annual service costs for storing
9 information, storing the data that's being
10 recorded.

11 Overall, the benefit-to-cost ratio was
12 above 1.0. It should be noted that this analysis
13 also included a 20 percent derate to the savings
14 to account for any behavior issues in regards to
15 fixing leaks associated that were identified
16 through the monitoring process.

17 Statewide, this monitoring measure is
18 expected to save 29.3 gigawatt hours of
19 electricity and reduce greenhouse gas emissions
20 by 7,000 tons.

21 Again, this measure is expected to be
22 cost effective in all climate zones. And as with
23 other compressed air measures, it is expected to
24 standardize best practices for compressed air
25 systems. Also, there are a number of compressed

1 air monitoring systems on the market. And there
2 are a number of -- or there are studies that have
3 been made regarding the effectiveness of
4 monitoring systems at compressed air sites.

5 Before taking questions on this measure
6 or this proposal as a whole, there are a few
7 items that I would like to get public opinion on
8 regarding these measures. And you can answer now
9 or you can provide comments to our docket.

10 First, regarding pipe sizing, is
11 verification of compressed air piping required to
12 ensure appropriate piping was installed? This
13 isn't part of the proposal. And I know that
14 there are concerns about how much it would cost
15 to do this verification. And we just kind of
16 wanted to reach out to the public to see what
17 they thought about that.

18 For compressed air monitoring systems,
19 are the identified monitoring points and
20 procedures adequate to identify compressed air
21 system issues?

22 And, also, just if you would like to
23 weigh in regarding the 80 percent realization
24 rate for compressed air monitoring savings,
25 please feel free to do so on that end as well.

1 We'd like to hear comments about that.

2 But with that, if you have any questions
3 or comments regarding this part of the measure,
4 or anything, any other proposal associated with
5 the compressed air systems, we can take those
6 now.

7 MR. BOZORGCHAMI: Oh, we have one raised
8 hand. Meg Waltner.

9 Meg, you are muted. So if you un-mute
10 yourself, you're -- there you go.

11 MS. WALTNER: can you hear me now?

12 MR. BOZORGCHAMI: Yeah. Perfect.

13 MS. WALTNER: Hi. Meg Waltner with
14 Energy 350.

15 Overall, just wanted to voice support for
16 this measure. I think both the sizing and
17 testing requirements, as well as ongoing
18 monitoring, will ensure that compressed air
19 systems reduce their energy use.

20 And, you know, we do a lot of leak
21 detection in compressed air systems for the
22 Energy Trust of Oregon and do find that these
23 systems leak over time. And so the monitoring,
24 in particular, will help catch those leaks and
25 stop unnecessary energy use.

1 I did have one question. For the less
2 than 50 foot new compressed air piping, did you
3 consider ultrasonic leak detection as a potential
4 means of verification of that?

5 MR. BUCANEG: I believe we did. I know
6 that previous versions of the draft language did,
7 I believe, identify ultrasonic.

8 You would still be able, under the
9 proposed Code language, I believe you would still
10 be able to use that if jurisdictions would
11 allow -- the jurisdiction having authority would
12 allow for it.

13 But, yes, I believe that was also one of
14 the leak detection options that were originally
15 proposed.

16 MS. WALTNER: Okay. That's how we
17 typically do leak detection in existing systems.
18 I think for less than 50 feet length, as you have
19 it proposed, makes sense, but it's something else
20 you could consider adding for flexibility.

21 MR. BUCANEG: Okay. Thank you for the
22 input on that.

23 MR. BOZORGCHAMI: Thank you, Meg.

24 Any other comments? Questions?
25 Concerns?

1 With that, Haile, I think we're going to
2 pass it on to Cheng to do his part of the
3 presentation.

4 MR. BUCANEG: Yup.

5 MR. MOUA: All right. Can you guys here
6 me okay, Payam?

7 MR. BOZORGCHAMI: Awesome. Thank you.

8 MR. MOUA: Okay. And you're able to see
9 my screen; correct?

10 MR. BOZORGCHAMI: Yes.

11 MR. MOUA: Okay. So, okay, thank you and
12 good morning everyone. Hopefully everyone is
13 doing well. My name is Cheng Moua and I am a
14 Mechanical Engineer here in the Building
15 Standards Office. I will be going over the
16 refrigeration system opportunities, the proposal
17 for 2020 Nonres Covered Process sections.

18 So these are also proposals submitted by
19 the Case Team, so thank you, Case Team, for doing
20 so.

21 So there are two measure proposals
22 relating to refrigerated systems in commercial
23 refrigeration and refrigerated warehouses. They
24 introduce new mandatory requirements for the
25 design and control of transcritical CO2 systems.

1 And they also specify requirements for automatic
2 door closers. So I'll be going over each one in
3 detail.

4 The sections affected by these two
5 measures are those for Covered Process, Section
6 120.6(a) for Refrigerated Warehouse, and Section
7 120.6(b) for Commercial Refrigeration. There
8 will also be new acceptance tests introduced in
9 the Reference Appendices NA7 for the
10 Transcritical CO2 Measure.

11 So the first measure we'll cover is
12 Design and Control Requirements for Transcritical
13 CO2 Systems.

14 So I'm sure many of you on the line are
15 already familiar with what transcritical CO2
16 systems are, but I'll try my best to briefly
17 introduce what they are and how they operate.

18 So transcritical CO2 systems are
19 refrigeration systems that use CO2 as the working
20 fluid. They operate at much higher pressures
21 than the common halocarbon refrigerants an
22 ammonia refrigerants.

23 Transcritical CO2 systems are somewhat
24 unique because they operate in one of two modes,
25 supercritical operation or subcritical operation.

1 And supercritical operation is where the system
2 is operating above the critical point after the
3 vapor compression stage. So this occurs during
4 higher ambient temperatures, typically when
5 ambient temperatures are 75 degrees or above.
6 And during supercritical operation, the system
7 efficiency decreases. During lower ambient
8 temperatures, they operate below the critical
9 point, similarly to your common refrigerants.

10 And here's your vapor compression cycle.
11 On the left is the pressure-enthalpy diagram for
12 the conventional refrigerant. You can see, the
13 whole cycle occurs below the critical point
14 versus the pressure-enthalpy diagram on the right
15 side for CO2 systems. And this shows, during
16 supercritical operation, the compressions stage
17 from one to two, as you can see, ends up that
18 much higher pressures and much above the critical
19 point.

20 And the process from two to three, which
21 is the condensing stage for conventional
22 refrigeration, you're actually not condensing at
23 all during supercritical operations, so that's
24 known as the transcritical process. So for CO2
25 systems the equipment there is a gas cooler and

1 not a condenser.

2 And this is a diagram of a CO2 booster
3 system. There's the booster stage that serves
4 low-temperature loads. And that load temperature
5 compressor discharges into the section suction of
6 the high stage. And the high stage serves medium
7 temperature loads and compresses the gas into
8 high pressures. Heat is then rejected into the
9 gas cooler. So under subcritical operation the
10 gas cooler is -- again, operates just as a normal
11 condenser. The CO2 then cycles through the flash
12 tank in gas or liquid form, depending upon the
13 conditions. CO2 gas would cycle back into the
14 medium temperature compressor. And CO2 liquid
15 would cycle back down into the evaporators.

16 So why are requirements for CO2 systems
17 being proposed?

18 Over the recent years, transcritical CO2
19 systems are gaining popularity due to technology
20 innovation. Not only that but traditional
21 halocarbon refrigerants are being phased out due
22 to their high global warming potential and GWP.
23 So many types of refrigerants will no longer be
24 allowed for use in supermarkets and cold storage
25 in the future.

1 Part 6 has no current requirements for
2 transcritical CO2 systems, so this is an
3 opportunity for energy savings.

4 And the proposal also aims to provide
5 clarity for the design practice of CO2 systems
6 during this transition to low GWP refrigerants.
7 So some of the requirements proposed are really
8 to clarify what is considered standard practice
9 and already being done for CO2 systems.

10 And the proposed requirements are
11 applicable to refrigerated warehouses that are
12 greater than or equal to 3,000 square feet,
13 refrigerated spaces with a sum total of 3,000
14 square or more that are served by the same
15 refrigeration systems, retail food stores that
16 are 8,000 square feet or more, new construction,
17 additions, and alterations where an entirely new
18 refrigeration system is installed. So these
19 criteria are pretty much existing in the current
20 code for refrigerated warehouses and commercial
21 refrigeration.

22 So this table shows the estimated new
23 construction that could be impacted by the CO2
24 systems proposal. As you can see, 1.6 million
25 square feet is estimated for refrigerated

1 warehouses, 8.4 for commercial refrigeration.
2 And the Case Team estimates that new
3 construction, for new construction, 10 percent is
4 estimated to be transcritical CO2 systems in the
5 future for refrigerated warehouses. And 30
6 percent would be estimated to be transcritical
7 CO2 systems for commercial refrigeration. And
8 the statewide new construction impacted is there
9 on the column on the right, a million square
10 foot.

11 So here's a table that estimates the
12 existing building stocks' square footage. It's
13 assumed that existing refrigerated warehouses and
14 commercial refrigeration will not be impacted by
15 this proposal, simply because it's not expected
16 to -- it's not expected that exiting refrigerated
17 systems be converted to transcritical CO2
18 systems.

19 So what requirements are being proposed?

20 It does mandate the use of transcritical
21 CO2 systems but it does establish mandatory
22 design and control requirements for CO2 system
23 when they are utilized. So these include design
24 specifications for air-cooled gas cooler
25 restriction, gas cooler sizing and specific

1 efficiency, supercritical optimized head pressure
2 control, subcritical ambient temperature reset
3 control, minimize saturated condensing
4 temperature setpoint, and heat recovery.

5 So to get into a little bit of the
6 details, the air-cooled gas cooler restriction
7 requirement restricts the use of air-cooled gas
8 coolers in high ambient temperature climate zones
9 in order to reduce the number of supercritical
10 operating hours. And these Climate Zones are 9
11 through 15 for refrigerated warehouses and 10
12 through 15 for commercial refrigeration.

13 Alternative options to air-cooled gas
14 coolers are water-cooled condensers, adiabatic
15 gas coolers, and evaporative gas coolers.

16 The gas cooler sizing and specific
17 efficiency requirements ensure that cost-
18 effective design of the refrigeration system's
19 heat rejection equipment, balancing first cost of
20 the equipment and the additional energy saving
21 that are achieved with larger heat exchanger
22 surfaces.

23 The supercritical optimized head pressure
24 control allows for the head pressure setpoint to
25 be reset in response to ambient conditions.

1 And the subcritical ambient temperature
2 reset control strategy aligns the head pressure
3 control strategy with existing Code language.

4 The minimum saturated condensing
5 temperature setpoint applies to systems with
6 design saturated suction temperatures of less
7 than 30 degrees Fahrenheit.

8 So heat recovery in supermarkets,
9 refrigeration equipment in supermarkets create a
10 heating load to maintain comfortable space
11 temperatures for shoppers. So as a result, this
12 requires heating for more hours than most
13 occupancies. And, in most climate zone, waste
14 heat from the refrigeration system can be
15 recovered to provide heating more efficiently.

16 So apologies as this is kind of really
17 getting into the weeds. But this is probably the
18 best way to share exactly what's being proposed
19 for the transcritical CO2 measure. This is the
20 language that is being proposed for Refrigerated
21 Warehouse, Section 120.6(a)5. So A here is the
22 restriction for air-cooled gas coolers; B is
23 specification designs for leaving gas temperature
24 for air-cooled gas coolers; C, design leaving gas
25 temperatures for adiabatic gas coolers; and D,

1 requires all gas cooler fans to be continuously
2 variable speed.

3 Continuing on, while operating the below
4 the critical point, the gas cooler pressure shall
5 be controlled in accordance to 120.6(a)4F. So
6 that section is, basically, covering condensing
7 temperature reset.

8 While operating above the critical point,
9 the gas cooler pressure setpoint shall be reset
10 based on ambient conditions such that the system
11 efficiency is maximized.

12 The minimum condensing setpoint shall be
13 less than or equal to 60 degrees Fahrenheit for
14 gas coolers.

15 And fan-powered gas coolers shall meet
16 the gas cooler efficiency in Table 120.6-F. And
17 here is that table for 120.6-F, the Minimum
18 Efficiency Requirements. And this is for
19 refrigerated warehouses.

20 So for commercial refrigeration, this is
21 the proposed language, Sections 120.6(b)2. It's
22 very similar to the refrigerated warehouses with
23 some minor tweaks to it. I'm not going to read
24 it all over again. But I included it here as
25 part of this slide deck since these will be

1 posted. And this language is also in the Case
2 Report.

3 Continuing on in that section. And,
4 similarly, 120.6-H for refrigerated warehouses

5 So getting into the energy savings, two
6 prototype buildings were modeled to estimate the
7 energy savings, a large refrigerated warehouse
8 and a large supermarket at 92,000 square feet and
9 60,000 square feet respectively. If you're
10 interested in the detailed layouts, these can be
11 found in the Case Report.

12 DOE2.2R software was used to estimate the
13 energy impacts. And per-unit energy impacts were
14 calculated for each of the submeasures. The
15 table here shows the submeasure name, and the
16 parameter, and the standard and the proposed for
17 each of the submeasures.

18 So for air-cooled gas cooler restriction,
19 for example, the standard design was the air-
20 cooled gas cooler type, and the proposed was an
21 adiabatic gas cooler. For the minimum air-cooled
22 gas cooler sizing and specific efficiency
23 requirement, the standard design was eight
24 degrees Fahrenheit rated approach temperature.
25 And for the proposed multiple parametric,

1 analysis was done at different temperatures but
2 six degrees was the one selected.

3 For the heat recovery submeasure, there
4 was also a spreadsheet analysis that was
5 performed, in addition to the simulations.

6 And the submeasures for supercritical
7 optimized head pressure control, subcritical
8 ambient temperature reset control, and minimum
9 saturated condensing temperature setpoint, the
10 Case Team considered as standard practice. So
11 these submeasures are included in the proposal
12 to, basically, provide clarity on what's already
13 occurring in the industry. So they are assumed
14 to have no additional energy savings or no
15 additional costs to transcritical CO2 systems.

16 And this is getting into the results. So
17 energy impact, again, per square foot were
18 calculated. And this is the large refrigerated
19 warehouse prototype for the air-cooled gas cooler
20 restriction requirement for a submeasure.

21 And next is the same prototype but for
22 the air-cooled gas cooler sizing, again, at six
23 degrees.

24 And then this is now looking at the
25 energy impacts per square foot for the large

1 supermarket prototype from the air-cooled gas
2 cooler restriction.

3 And for the same prototype, large
4 supermarket, air-cooled gas cooler sizing.

5 And, lastly, this is the heat recovery
6 requirement for a large supermarket.

7 So getting into incremental cost, so this
8 is the first cost, the air-cooled gas cooler
9 restriction requirement. The price difference
10 between and air-cooled and adiabatic gas cooler
11 was used to determine a percent cost increase.
12 That was then applied to each climate zone for
13 each prototype. So pricing data was collected
14 from multiple manufacturers and found to be
15 approximately 30 percent more for adiabatic gas
16 coolers and estimated a \$3,000 difference for
17 labor. So for the large refrigerated warehouse
18 prototype, a total of \$83,000 was the incremental
19 first costs. And for the large supermarket
20 prototype, a total of \$34,000 was the estimated
21 incremental first costs.

22 For the minimum gas cooler sizing and
23 specific efficiency, the Case Team established an
24 average cost per unit of heat rejection capacity.
25 This incremental size increase associated with

1 the change in the rated temperature difference
2 between the gas cooler outlet temperature and the
3 ambient air temperature was converted. So \$5,000
4 per degree approach temperature difference was
5 for large refrigerated warehouses. And \$2,500
6 per degree approach temperature difference was
7 for supermarkets.

8 And for the incremental first cost of the
9 heat recovery requirement, equipment was
10 considered, materials, labor, taxes, et cetera, a
11 total of \$51,000 for the supermarket prototype.

12 And this is going into the maintenance
13 and replacement cost, incremental maintenance and
14 replacement cost over the 15-year analysis
15 period. So for the air-cooled gas cooler
16 restriction measure, maintenance needed for pre-
17 cooling pads and control strategy estimated at
18 \$64,000 for large refrigerated warehouse and
19 \$32,000 for a large supermarket.

20 So this is considering replacements and
21 maintenance needed for the proposed adiabatic gas
22 cooler, so three replacement costs for the pre-
23 cooling pads estimated at \$120,000 and \$60,000
24 for each prototype.

25 And water usage and sewer costs were also

1 considered.

2 For the gas cooler sizing and specific
3 efficiency, there was no incremental maintenance
4 replacement cost for this measure.

5 For the heat recovery submeasure, and
6 estimation of \$800 per year for maintenance, and
7 that totals to approximately \$9,500.

8 So with the energy cost savings and the
9 incremental costs, we now could calculate the
10 benefit-to-cost ratio, and that's what this table
11 shows here, broken down by climate zone. And
12 this is for the large refrigerated warehouse
13 prototype for the air-cooled gas cooler
14 restriction submeasure. As you can see, it's
15 cost effective in Climate Zones 9 through 15
16 where it's being proposed, cost effective meaning
17 having a benefit-to-cost ratio of over 1.0.

18 And then, also, for the large
19 refrigerated warehouse, for the gas cooler sizing
20 submeasure, it's cost effective in Climate Zones
21 1, 3, 5, 6, 7, and 16, where it's being proposed.
22 And for zone -- I mean for Climate Zones 9
23 through 15, it's great out here because it really
24 doesn't apply due to the previous submeasure for
25 the air-cooled gas cooler restriction, so it's

1 being restricted in these climate zones.

2 For the large supermarket prototype under
3 the air-cooled gas cooler restriction submeasure,
4 it's cost effective in Zones 10 through 15 where
5 it's being proposed. And then for the large
6 supermarket prototype, the gas cooler sizing
7 submeasure is cost effective in all climate zones
8 but restricted in Zones 10 through 15.

9 And this is the cost effectiveness
10 summary for the heat recovery submeasure. It's
11 cost effective in all climate zones except for
12 Zone 15 where it's being excluded.

13 So the first year statewide energy
14 impacts, so all the requirements for our
15 transcritical CO2 systems is estimated to have
16 electricity savings of 1.51 gigawatt hours per
17 year and 1.13 megawatt hours of demand reduction.
18 This converts to a TDV energy savings of over 7
19 million kBtus per year. And those the energy
20 savings convert to a 140 metric ton CO2 emissions
21 reduction, or avoided.

22 So that's it for transcritical CO2
23 systems. We could go to questions.

24 Payam, do you see any questions?

25 MR. BOZORGCHAMI: Yeah. I'm going to

1 open up the dialogue for Mr. Nick Harbeck. He
2 has a question. And I'm just going to ask him to
3 answer it out -- question it verbally.

4 MR. MOUA: Sure. And just to let
5 everyone know, Trevor Bellon should be on. He's
6 the case author for this measure proposal.

7 MR. HARBECK: Thank you. Can you hear me
8 okay?

9 MR. MOUA: Yes.

10 MR. HARBECK: Hi. Yeah. This is Nick
11 Harbeck with AHRI. Thank you again for this
12 presentation. I just wanted to quickly ask a few
13 question that, maybe, you might be able to
14 answer.

15 Can you please explain what sort of
16 criteria was used to list the different design
17 and control requirements in the Transcritical CO2
18 section of the report?

19 And then as a follow up, why was that
20 criteria chosen? And if it was based on like a
21 minimum of energy savings, what was the basis for
22 that determination?

23 Thank you.

24 MR. MOUA: Yeah, I believe the Case Team
25 reached out to manufacturers and did surveys.

1 But Trevor could probably add more to that. I
2 know all that information --

3 MR. BELLON: Yeah. This is --

4 MR. MOUA: -- is in his report.

5 MR. BELLON: This is Trevor. Can
6 everyone hear me okay?

7 MR. MOUA: Yes.

8 MR. BELLON: So, yeah, we did review
9 available technologies that would contribute to
10 energy savings for CO2 systems, so that included
11 things not included in this report, like parallel
12 compression for gas ejectors. It really wasn't a
13 criteria of energy savings, necessarily, but in
14 part due to feasibility and making sure that we
15 are not implementing something that isn't widely
16 adopted yet or may have issues with wide-scale
17 adoption. And also, of course, looking at the
18 cost effectiveness of the measures was extremely
19 important as well.

20 MR. BOZORGCHAMI: Thanks Trevor.

21 Nick, do you have any other questions or
22 comments you would like to make on that?

23 MR. HARBECK: No. That helps. Thank you
24 very much.

25 MR. BOZORGCHAMI: Okay.

1 MR. HARBECK: I appreciate your time.

2 MR. BOZORGCHAMI: You're welcome. Thank
3 you.

4 MR. MOUA: So anything else, Payam?

5 MR. BOZORGCHAMI: Anybody else?

6 How about, Cheng, let's move on to your
7 next topic, please, the door.

8 MR. MOUA: Sure. We can move on and
9 always come back at the end.

10 So the last measure that I'll be
11 covering, well the last submeasure for this
12 workshop today, also, is Automatic Door Closers.

13 So there's two main types of automatic
14 door closers. The first is a mechanism that
15 closes the door from standing open position. And
16 the second is a mechanism that tightly seals the
17 door to the frame to eliminate air leakage. And
18 this is picture examples of what some of those
19 looks like for a spring hinge, cam hinge, and the
20 snap type.

21 So what requirements are being proposed?
22 So this measure proposal would define,
23 specifically, the types of door closers and
24 require them for refrigerated spaces 3,000 square
25 feet and over. So this aligns Part 6 with Title

1 20 and federal requirements for refrigerated
2 spaces less than 3,000 square feet. And this
3 also applies to new construction, additions, and
4 alterations.

5 So this table, basically, summarizes what
6 I just mentioned. Less than 3,000 square feet,
7 automatic door closers are already required under
8 federal and California Title 24. Part 6 doesn't
9 apply. And nothing is being proposed in Part 6.
10 But then over 3,000 square feet, there's no
11 federal standards. California Title 20 does not
12 apply. What the current existing Part 6 allows
13 for is option for automatic door closers, an air
14 curtain, or strip curtains. And then what's
15 being proposed, of course, is a requirement for
16 automatic door closers.

17 So why are these requirements being
18 proposed? Simply because people forget to close
19 doors or don't shut them all the way.
20 Infiltration barriers reduce cooling loads by
21 preventing warmer air from entering the
22 refrigerated spaces. Automatic door closers are
23 one of the most cost-effective ways to save
24 energy in a grocery store and refrigerated
25 warehouses.

1 Regarding technical feasibility and
2 market availability, it's already required for
3 spaces less than 3,000 square feet. So the door
4 closer market is well established, having
5 multiple manufacturers producing different types.
6 And many supermarkets already use them. And it's
7 cost effective in all climate zones except for
8 16.

9 So similarly to the previous measures,
10 prototype buildings were modeled to estimate the
11 savings with a large refrigerated warehouse and a
12 small refrigerated warehouse prototype. And the
13 table on the bottom shows a breakdown of that
14 refrigerated space to calculate the energy
15 savings.

16 And DOE2.2R was also used for this
17 measure. And the table here summarizes the
18 parameters that were considered for the energy
19 savings. So if you look at the column under
20 parameter name, there's infiltration for each
21 exterior door, passage time per door opening,
22 stand-open time per hour for each interior door,
23 and leakage when door is closed. And then under
24 the standard design values and the proposed
25 design values, you can see those numbers there.

1 So per-unit energy impacts were
2 calculated and this is the results. This is the
3 first year energy impacts per square foot. So
4 there's electricity savings and TDV energy
5 savings in every climate zone.

6 Getting into the incremental first costs,
7 this is per door, snap closer mechanisms,
8 spring/cam hinge mechanism, labor, taxes,
9 totaling \$707 per door. So that per-door
10 estimate was estimate was converted into a first
11 cost per square foot. So number of doors per
12 prototype is ten, multiplied over by the cost
13 that we just went over, divided by the square
14 footage. So an incremental cost per square
15 footage was calculated to be \$0.077 per square
16 foot. And the energy cost savings and the total
17 incremental (indiscernible) costs, we just
18 covered, resulting in benefit-to-cost ratios for
19 all climate zones, except 16, to be cost
20 effective.

21 And this is a table summarizing the
22 statewide energy and energy cost impacts for new
23 construction. So approximately 1.6 million
24 square feet total for all climate zones. First
25 year electricity savings, 109,000 kilowatt hours,

1 estimated to produce energy cost savings of
2 279,000 expressed in million dollars present
3 value.

4 So for additions and alterations, it was
5 estimated that five percent of the existing
6 building stock would be impacted by this measure.
7 So the square footage was taken and, for here,
8 electricity savings were estimated for that
9 percentage. And that's where you see the middle
10 row for additions and alterations at 252,000 kWh.
11 And then adding both new construction and
12 additions and alterations results in
13 approximately 260, kWh per year. And this is
14 estimated to reduce GHG emissions by 86 metric
15 tons CO2.

16 So that's it for the submeasures. But in
17 closing, a copy of the Case Report can be found
18 on our docket here listed at this link. It has
19 all the information I covered, plus more.

20 And how to submit comments, the preferred
21 method is to use our docket system to submit an
22 e-comment. And you can also submit by email.
23 Include the Docket Number 19-BSTD-03 and the
24 subject line for 2022 Building Energy Efficiency
25 Standards. And as Payam mentioned, comments are

1 due for all the submeasures today by October 7th,
2 2020.

3 So we'll get back into questions again.

4 And here's my contact information, as
5 well as Payam's and Larry's.

6 Payam, do you see any questions?

7 MR. BOZORGCHAMI: No. Any questions on
8 what Cheng has proposed and/or what you have
9 heard today?

10 Again, you can either contact the
11 presenters directly or -- if you have any
12 questions, or you can submit your comments to the
13 docket. And the docket information is provided
14 with the PowerPoint presentation. I will make the
15 PowerPoint presentation available tomorrow,
16 probably first thing in the morning.

17 And with that, I thank you. Thank you
18 for your time.

19 (The workshop concluded at 11:04 a.m.)

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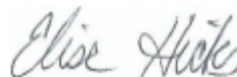
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CERTIFICATE OF REPORTER

I do hereby certify that the testimony in the foregoing hearing was taken at the time and place therein stated; that the testimony of said witnesses were reported by me, a certified electronic court reporter and a disinterested person, and was under my supervision thereafter transcribed into typewriting.

And I further certify that I am not of counsel or attorney for either or any of the parties to said hearing nor in any way interested in the outcome of the cause named in said caption.

IN WITNESS WHEREOF, I have hereunto set my hand this 5th day of October, 2020.



ELISE HICKS, IAPRT
CERT**2176

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I do hereby certify that the testimony in the foregoing hearing was taken at the time and place therein stated; that the testimony of said witnesses were transcribed by me, a certified transcriber and a disinterested person, and was under my supervision thereafter transcribed into typewriting.

And I further certify that I am not of counsel or attorney for either or any of the parties to said hearing nor in any way interested in the outcome of the cause named in said caption.

I certify that the foregoing is a correct transcript, to the best of my ability, from the electronic sound recording of the proceedings in the above-entitled matter.



MARTHA L. NELSON, CERT**367

October 5, 2020