

DOCKETED	
Docket Number:	21-IEPR-06
Project Title:	Building Decarbonization and Energy Efficiency
TN #:	239219
Document Title:	Transcript - 6-22-21 for SESSION 1 BUILDING DECARBONIZATION EQUIPMENT, TECHNOLOGY, AND SUPPLY CHAIN
Description:	6-22-2021_Session 1_IEPR Workshop transcript FINAL
Filer:	Raquel Kravitz
Organization:	California Energy Commission
Submitter Role:	Commission Staff
Submission Date:	8/9/2021 5:06:48 PM
Docketed Date:	8/10/2021

CALIFORNIA ENERGY COMMISSION
IEPR LEAD COMMISSIONER WORKSHOP

In the Matter of:)	Docket No. 21-IEPR-06
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)	
RE: <i>IEPR Commissioner Workshop</i>)	COMMISSIONER WORKSHOP
<i>on Building Decarbonization -</i>)	
<i>Equipment, Technology, and</i>)	
<u><i>Supply Chain</i></u>)	

SESSION 1: BUILDING DECARBONIZATION: EQUIPMENT, TECHNOLOGY,
AND SUPPLY CHAIN

REMOTE ACCESS ONLY

JUNE 22, 2021
SESSION 1: 9:00 A.M.

Reported By:
Elise Hicks

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

2 JUNE 22, 2021

9:01 a.m.

3 (On the record at 9:01 a.m.)

4 MS. RAITT: All right, good morning, everybody.
5 Welcome to today's 2021 IEPR Commissioner Workshop on
6 Building Decarbonization: Equipment, Technology, and Supply
7 Chain. I'm Heather Raitt, the Program Manager for the
8 Integrated Energy Policy Report, which we refer to as the
9 IEPR. This workshop is being held remotely, consistent
10 with the Executive Order N-08-21 to continue to help
11 California respond to, recover from, and mitigate the
12 impacts of the COVID-19 pandemic. The public can
13 participate in the workshop consistent with the direction
14 in the executive order.

15 To follow along, presentations submitted today by
16 the panelists have been docketed and are posted on our
17 website with possibly one exception of a presentation that
18 will be posted later today.

19 All workshops are recorded, and both a recording
20 and a written transcript will be linked to the Energy
21 Commission's website following this workshop.

22 Attendees have the opportunity to participate
23 today in a few different ways. For those of you joining
24 through the online Zoom platform, the Q&A feature is
25 available for you to submit questions. You may also upvote

1 a question submitted by someone else. You just click the
2 thumbs-up icon to upvote. Questions with the most votes
3 are moved up to the top of the queue. We'll reserve a few
4 minutes near the end of each panel to take questions from
5 the Q&A, but we're likely not to have time to address all
6 questions submitted.

7 Alternatively, attendees may make comments during
8 the public comment period at the end of the morning and
9 afternoon sessions. Please note we will not be responding
10 to questions during the public comment period. Written
11 comments are also welcome, and instructions for doing so
12 are on the meeting notice, and written comments are due
13 July 7th.

14 With that, I'll turn it over to Commissioner
15 Andrew McAllister for opening remarks. Thank you,
16 Commissioner.

17 COMMISSIONER McALLISTER: Great, thank you,
18 Heather. Well, really a pleasure to be here. I am Andrew
19 McAllister, Lead Commissioner on this year's IEPR. We have
20 a series of workshops on a number of different themes: on
21 reliability, on the gas system, and on building
22 decarbonization, as well, in addition to the forecast that
23 is the bread and butter of the IEPR every time we do it.

24 Building decarbonization is a key climate
25 strategy for the state of California going forward and

1 maybe for the whole country. I think we are leading in
2 this area. We're trying to establish really a national
3 conversation and lead that conversation, together with some
4 of the other leading states, because it is absolutely
5 fundamental and critical to our state and nation having any
6 chance of meeting our long-term climate emissions and
7 energy goals. So our buildings are where we use most of
8 our energy, where we spend most of our time, and where we
9 have to find solutions to invest for climate neutrality.

10 So a key part of that is what we'll talk about
11 today, which is the actual nuts and bolts: the equipment,
12 technology, and supply chain. How are we getting
13 equipment, worker focus, finance to this critical sector of
14 our economy? So we're focusing on the technical piece
15 today: equipment and getting that equipment to jobs.

16 We will have -- I'll just give a little preview.
17 This is one of a series, as I said, of building
18 decarbonization workshops within the IEPR. We have also
19 produced the AB 3232 report. That staff report is out and
20 will be finalized and sent to the legislature later this
21 summer. And we have already had one workshop within the
22 IEPR on building decarbonization, sort of set the stage.
23 But we will have additional workshops on equity, on the
24 workforce, on financing, on industrial and agriculture,
25 which are two sectors that really desperately need

1 attention and resources. And, luckily, in the May revised
2 budget, it looks like industry is going to get some funds
3 and will be running a program if that happens. You know,
4 there's some prospect of a program to move the needle in
5 the industrial sector and really work with those partners,
6 as well. We already work with the ag sector quite a bit.
7 So all of these different sectors of our built environment
8 and our economic activity, decarbonization is job one.

9 And happily, as we've already started talking
10 about in the IEPR and will do so more, the building
11 decarbonization efforts dovetail quite well with energy
12 reliability and supporting some of our other goals which is
13 resilience, reliability, load flexibility, and many
14 other -- and as sort of a part of -- all key parts of the
15 whole of the electric system of the future which will be
16 the basis for our economy in a decarbonized California.

17 So this workshop today is part of a series that
18 really is that whole. You know, it's one piece of the
19 puzzle that we're going to address today, but it is part of
20 a broader effort that is, you know, kind of well-conceived
21 and strategic. And so I just wanted to anticipate that for
22 people and give you a little preview so that you can tune
23 in and really see that bigger context.

24 We are also in this IEPR cycle going to really do
25 the heavy lifting to translate between what we

1 traditionally think of as energy efficiency and
2 decarbonization because they obviously are rowing in the
3 same direction, but they're not exactly the same thing. So
4 later in the summer, we'll have a workshop to align the
5 energy and carbon pieces, so energy under SD350 and carbon
6 under, you know, our long-term carbon goals that are
7 codified in statute in a number of different places and
8 which actually are subject to efforts across all of our
9 energy agencies in the state, the PUC and the Air Resources
10 Board, as well. So part of this cycle of IEPR building
11 decarbonization workshops will be having joint agency,
12 jointly noticed workshops, and have the dais with our
13 colleagues from those other agencies, as well.

14 So I'm saying all this to really give folks an
15 appreciation of the coordinated and strategic high-level
16 effort that is really going into conceiving and
17 implementing a workshop cycle this IEPR around building
18 decarbonization.

19 So really excited to have -- we have a series of
20 great panels and -- presentations and panels today. I want
21 to thank staff, Jen Nelson, Gabe Taylor, and Mike Sokol and
22 all the staff that have been involved in this, in putting
23 this together, making, you know, pulling the speakers
24 together, and getting all the nuts and bolts taken care of
25 and buttoned up for this workshop and those to come. So I

1 want to appreciate also Heather and the IEPR team for their
2 just high level of professionalism in executing these
3 workshops. So we have a good day ahead of us today. I
4 believe we have one or two of my colleagues from the
5 Commission online, Commissioner Gunda, Commissioner
6 Monahan, and would invite --

7 Oh, I'm seeing a note from Heather that they have
8 not joined yet, so I think it's just myself on the dais for
9 our commissioners and happy to pass it back to Heather for
10 kicking us off with the first speaker.

11 MS. RAITT: Great. Thank you, Commissioner. So,
12 yes, our first set of speakers is on the Scale of Building
13 Decarbonization in California, and the first speaker is
14 Michael Kenney, from the Energy Commission. He's an Energy
15 Specialist in the Existing Building Office in the
16 Efficiency Division.

17 Go ahead, Michael.

18 MR. KENNEY: Good morning, everybody. My name is
19 Michael Kenney. As Heather mentioned, I'm an Energy
20 Specialist here at the California Energy Commission, and
21 today I'm presenting building characteristics and
22 challenges as they relate to California building
23 decarbonization, and I'll be providing some updates to
24 energy efficiency and electrification analysis.

25 So this presentation will provide context for the

1 rest of the day as we discuss building decarbonization,
2 supply chains, equipment, and technologies.

3 Reaching deep building decarbonization will
4 require addressing the millions of existing residential and
5 commercial buildings in the state. So, first, I'll be
6 breaking down the sectors. Homeowners and renters have
7 overlapping and differing challenges when it comes to
8 decarbonizing, which we will touch on a bit today. Owners,
9 operators, and tenants of commercial buildings face similar
10 challenges. Both sectors will need large-scale equipment
11 replacement to be more efficient and, in many cases,
12 provide all electric alternatives, so I will also be
13 covering both the building and customer challenges.

14 The Energy Commission also continues to expand
15 and improve its modeling of energy efficiency and building
16 electrification, which I'll discuss last.

17 So we'll start with residential buildings. Today
18 there are around 13.2 million households in the state.
19 This is from our 2019 IEPR demand forecast. And households
20 are broken up to about 64 percent single-family, 32 percent
21 multifamily, and 4 percent mobile homes. So this is the
22 scale of the existing building stock that must be
23 retrofitted, not all at once, of course, but eventually, to
24 reach our long-term climate goals.

25 Thinking about the rate of new construction over

1 the next decade, the Energy Commission forecasts about
2 120,000 new households per year, which would put us on
3 track for about 14-and-a-half million households by 2030.
4 However, when we compare this to a recent report from the
5 California Department of Housing and Community Development,
6 we see that the state needs to add around 180,000 new
7 households per year. So this would result in a gap between
8 the number of households we anticipate existing and the
9 number of households we anticipate the state will need.
10 The chart on the right side of the screen shows this. We
11 see the number of single-family, multifamily, and mobile
12 homes as of 2019 and see how the projected growth over the
13 next decade compares to the needed homes over that same
14 date range. Note that due to the new efficiency standards,
15 new homes will have significantly lower greenhouse gas
16 emissions than older existing buildings.

17 Next slide. So now we turn to commercial
18 buildings. There are an estimated 7.3 billion square feet
19 of commercial floor space in the state, and by 2030 the
20 Energy Commission estimates that will grow by over 400
21 million square feet. On the right side we see a chart that
22 breaks down the sub-sectors that make up the commercial
23 building sector and their estimated square footage. So the
24 dominant building types are office spaces, retail,
25 warehouses, and miscellaneous. Miscellaneous is made up of

1 dozens of sub-sectors including churches, gas stations,
2 prisons, and movie theaters and others.

3 As we think about the growth of this sector
4 overall, we would expect some of our assumptions to be
5 overturned since we've had to adapt business practices in
6 response to the pandemic. Pre-pandemic, teleworking was
7 not widely done, and even before the pandemic, retail sales
8 were struggling due to the growth of online shopping. And
9 recent studies have found that as the commercial sector is
10 emerging from the pandemic, the retail sector continues to
11 struggle. And experts also expect a contraction in the use
12 of existing office spaces and in the construction of new
13 office spaces. They're also seeing vacancy rates
14 increasing across the state in commercial buildings. It's
15 not all doom and gloom, though, as warehouses and mixed-use
16 spaces and other sub-sectors are expected to rebound.

17 Next slide. With the scope of the residential
18 and commercial building sector defined, we can now turn to
19 thinking about the challenges that manufacturers,
20 distributors, contractors, program implementers, and others
21 may face when they work to decarbonizes these buildings.
22 First off, we must account for building age and condition,
23 especially within the residential sector. The majority of
24 homes were built to older energy codes. In fact, most
25 homes were built before the first Building Energy

1 Standards, though we know that some have undergone
2 retrofits since being built. We must also address building
3 stock over the next decade that is predominately 20 to 30
4 years old or older.

5 Secondly, as our focus shifts to more electric
6 end uses in buildings, it will change the ways that new
7 buildings are constructed in terms of planning, developing,
8 considering material costs and more.

9 While addressing new construction, we must also
10 support more affordable housing construction. Focusing
11 only on building new single-family homes will not benefit
12 the millions of households on lower incomes who need access
13 to subsidized housing and adequate living conditions.

14 And beyond building construction, we must think
15 about the availability of equipment and the needs of that
16 equipment. Especially important in today's discussions is
17 the availability of heat pumps, low-amperage equipment, and
18 low global warming potential refrigerants, plus considering
19 the conditions under which electric panel upgrades are
20 needed or which technologies can be installed to avoid
21 those upgrades in the first place.

22 Lastly, much of the new equipment we install into
23 new and existing buildings will contain smart technology
24 that requires a stable internet connection. Currently,
25 about a quarter of households lack access to broadband

1 internet.

2 Next slide. Aside from building challenges, it
3 will be important to keep in mind these ongoing
4 considerations for households and businesses as you think
5 about developing and expanding supply chains.

6 What type of equipment should be going into
7 different building types and in which type of equipment
8 should we invest? In the last year, the median price for a
9 single-family home has risen to over \$800,000, and the
10 median price of a condo or a town home is now over
11 \$550,000, according to the California Association of
12 Realtors. This ongoing trend over the last five years, if
13 continued, puts the median cost of a single-family home
14 well over a million dollars in the next two years.

15 Statewide, rent prices are increasing in a similar fashion.
16 Rents have grown by over 50 percent over the last decade in
17 all major metropolitan areas, including Los Angeles, San
18 Diego, San Jose, San Francisco, Sacramento, and Long Beach.
19 This coincides with nearly 25 percent of households being
20 enrolled in rate assistance programs for their utility
21 bills.

22 Recent work by the CPUC on affordability has
23 found that low incomes are driving most of the utility bill
24 affordability concerns in the state as opposed to housing
25 costs.

1 Let me go back to slide 6. There we go. The
2 regions at greatest risk to utility cost increases further
3 exacerbating energy burden are located throughout the
4 central valley, including Fresno, Tulare, Bakersfield,
5 Modesto, Merced, Stockton, and Stanislaus County, in
6 southern California regions including Imperial County,
7 portions of Los Angeles, and San Bernardino County, and
8 regions around San Diego, plus portions of the East Bay,
9 Chico, Sacramento, and Lancaster. This all paints a
10 picture of households across the state having very limited
11 budgets and a limited ability to uptake new costs.

12 Turning to the commercial sector and to
13 businesses, as we emerge from the pandemic, we're seeing a
14 change to work spaces, especially offices, as noted
15 earlier. More people are teleworking instead of commuting,
16 and this will likely change investments in new office
17 spaces and impact the vacancy rates of existing office
18 spaces. Physical retail locations have been struggling.
19 They continue to struggle post-pandemic.

20 So when you think about decarbonizing offices and
21 retail locations, these are important considerations to
22 keep in mind. These are fluid situations, both in terms of
23 available capital for investments and the possibility that
24 these spaces may be repurposed. More and more we are
25 realizing the scale of the clean energy workforce that we

1 will need not only for supply side energy installations,
2 but for meeting potential building decarbonization goals.

3 The building sector was hit particularly hard by
4 the pandemic, so the first order of business is to hire
5 back employees and then work to expand the workforce. So
6 everyone involved, from regulators to manufacturers to
7 distributors, contractors, and beyond must be thinking
8 through how they can support and coordinate workforce
9 efforts.

10 Next slide. To summarize some of the household
11 and business challenges, also known as customer challenges,
12 it's clear that project financing is going to be an issue
13 for many people due to having limited capital on hand. So
14 anything that can be done to mitigate the cost of retrofits
15 or that lowers the amount of money the customer needs to
16 spend up front will go a long way in determining the
17 success of statewide decarbonization efforts.

18 Similar to up-front costs, any changes to
19 customers' utility bills need to be a consideration of
20 decarbonization programs. How can changes to the supply
21 chain and equipment choices result in a neutral or positive
22 utility bill impact?

23 Next, scheduling major equipment retrofits is
24 another challenge for multifamily and commercial buildings
25 and, to a certain extent, single-family spaces. It's one

1 thing to replace light bulbs or replace an individual
2 appliance, but with the scale of decarbonization needed,
3 we're talking more about whole building retrofits and
4 replacing multiple pieces of equipment. Therefore, it is
5 essential that we identify the points in time at which
6 buildings and occupants are capable of accommodating
7 retrofits.

8 Another challenge is the split incentive. When
9 investing in equipment replacements, there is a mismatch in
10 cost and benefits between the owners and renters, which has
11 traditionally created a disincentive for investments. This
12 must be considered as we design programs and do customer
13 outreach, keeping in mind that close to half of the state's
14 residents rent their home. So this is a significant issue
15 for the residential and commercial markets.

16 Next slide. Changing gears now from building
17 characteristics and challenges to the analysis that is
18 expected to be done in the 2021 IEPR for building
19 decarbonization. So every two years the Energy Commission
20 updates the energy efficiency forecast, also known as the
21 Additional Achievable Energy Efficiency Forecast, and since
22 2015 the Energy Commission has been updating progress
23 towards doubling energy efficiency by 2030. So this year
24 staff will be incorporating new data from utility and other
25 incentive programs to update historical energy efficiency

1 savings and to improve projections. They'll be adding new
2 energy efficiency programs into the projections,
3 incorporating updates to energy codes and standards,
4 considering the overlap between customer segments and
5 ensuring that we do not double-count savings, and
6 considering energy savings for market-based activities
7 outside of those previously captured. And on the bottom of
8 the screen you can see the time horizons for those
9 analyses.

10 Next slide. Staff will also be updating and
11 expanding how building electrification is analyzed,
12 shifting away from a what-if type of analysis to new load-
13 modifying projections. This includes disaggregating low-
14 income single-family and multifamily into separate
15 residential sectors, incorporating new data from utility
16 and other incentive programs, incorporating electrification
17 resulting from existing local ordinances as well as any
18 from Title 24 updates, incorporating more diverse space
19 conditioning load profiles, improving and expanding and
20 modeling of marginal annual and hourly emissions
21 intensities, exploring additional end-uses and fossil fuels
22 for electrification, disaggregating panel costs by building
23 type using the soon-to-be published RASS data,
24 collaborating with the California Air Resources Board to
25 update hydrofluorocarbon emission estimates. This work

1 will inform a building electrification load modifier
2 similar to the additional achievable energy efficiency
3 modifier. It will also improve upon the work done in the
4 Assembly Bill 3232, Building Decarbonization Assessment;
5 however, it will not be recreating the scenarios in that
6 report.

7 Next slide. Altogether, the improved energy
8 efficiency and new decarbonization analysis will result in
9 energy efficiency and building decarbonization hourly load
10 modifiers. Building electrification modifiers will have
11 different time horizons, uncertainties, and uses than the
12 energy efficiency modifiers. In addition, the Energy
13 Commission is developing new long-term demand scenarios.
14 These scenarios will look beyond the traditional 10- to 15-
15 year approach, out to 2050. This is necessary for energy
16 planning and procurement purposes and to track progress of
17 long-term climate and energy policies.

18 Next slide. Overall, California has a great
19 opportunity to invest in its people and buildings to
20 achieve a decarbonized economy; however, there are many
21 affordability and technical constraints to address. The
22 Energy Commission will continue to develop and improve its
23 decarbonization and efficiency modeling to support energy
24 planning and energy policies. I look forward to hearing
25 more from our presenters and panelists today as we all

1 develop solutions and pathways to building decarbonization.

2 Thank you.

3 MS. RAITT: Thank you, Michael --

4 Our next speaker is Le-Huy Nguyen, also from the
5 Energy Commission. He works in Energy Commission Data
6 Integration and Policy Analysis Office, and he's in the
7 Energy Assessments Division. Go ahead, Le-Huy. Thank you.

8 MR. NGUYEN: Thank you, Heather. Good morning,
9 Commissioners and folks on the phone. So, yeah, my name is
10 Le-Huy Nguyen, and I'm the Project Manager for the
11 Residential Appliance Saturation Study or commonly known as
12 the RASS, and I'll be presenting on some of the results for
13 this recently finished study.

14 So this study is authorized by the Warren-Alquist
15 Act, in which the Energy Commission is authorized to
16 collect sector-specific end-use data, so not just for the
17 residential sector; we also have the authority to collect
18 information for the commercial sector as well as the
19 industrial sector. Historically, the information collected
20 from the RASS is used as inputs for the Demand Office's
21 residential forecast model. And there have been two
22 previous statewide Energy Commission-sponsored RASSes, one
23 in 2003 and 2009. Before that, participating utilities
24 would conduct their own residential appliance studies and
25 submit the data to the Energy Commission for our

1 forecasting purposes.

2 Next slide, please. So now we're going to go
3 into kind of the objectives and the scope of the study. So
4 as mentioned before, there were two previous studies. So
5 the 2019 RASS seeks to update the results with the results
6 being used for statewide and utility forecasting. And the
7 represented -- or the represented utilities that
8 participated in this study were PG&E, Southern California
9 Edison, San Diego Gas and Electric, SoCalGas, Los Angeles
10 Department of Water and Power, and SMUD. So we sample at
11 the utility service territory and as well as the Energy
12 Commission's forecasting zones.

13 The study tries to collect data on appliances,
14 equipment, general consumption patterns, and then, but we
15 also collect some information on housing characteristics
16 and some demographics questions. So once we have the
17 collected data or the survey responses, we then use that
18 information to produce electrical and gas end-uses
19 saturations at the statewide and utility levels for
20 households with electric service. So homes that are off
21 the grid, they may not be counted.

22 Next slide, please. And then, additionally, we
23 will perform conditional demand analysis to develop unit
24 energy consumption estimates. And for this study we had 28
25 electrical and nine natural gas residential end uses. New

1 for this study, we also developed whole-house electric load
2 shape estimates, as well as gas daily use.

3 Next slide, please. So this slide just provides
4 a snapshot of how much of the population that the RASS
5 covers for each utility. So the sample size is about 4
6 percent of the population. And one interesting observation
7 from this chart is that the response rate was uniformly low
8 for all utilities compared to the 2009 RASS.

9 Next slide, please. So this slide is just
10 looking at annual electricity consumption with kind of what
11 end uses make up that consumption. It's interesting to
12 note that the annual electric consumption per home has
13 declined by about 2 percent between the two studies. But
14 as you can see, refrigerators and freezers still make up a
15 large portion of the energy consumption; whereas, you can
16 also see that air conditioning has also increased, and but
17 then TV, PC, and office equipment has decreased as
18 electricity consumption.

19 All right, next slide, please. So this chart is
20 just kind of showing the electric UECs and appliance
21 saturations by housing type. And I've only highlighted a
22 few because as, you know, as I mentioned before, there's 28
23 electrical end uses and we can only go through a few in the
24 short amount of time. And so I highlighted the ones that
25 we kind of thought would be of most interest for this

1 workshop. So for the first one, for the primary
2 conventional space heating, this one was where we saw kind
3 of a bigger jump or a bigger difference compared to the
4 2009 RASS. So for statewide, we saw a 15 percent
5 saturation where homes that would have a conventional,
6 electric conventional space heater, which, compared to
7 2009, it was estimated to be at only about 4 percent.

8 And then for the next, for water heating and
9 dryers, they stayed fairly consistent or fairly similar to
10 the 2009 RASS where their saturations only changed about 1
11 percent.

12 And then looking at the range and ovens, this one
13 changed a little more where we were reporting 47 percent as
14 the saturations statewide; whereas, it was only a slight
15 increase for electrical. Where, in 2009, we were reporting
16 44 percent.

17 So from -- just I wanted to do a quick comparison
18 with the single-family versus the multifamily. So if we're
19 just looking at those four appliances, you can see that
20 almost across the board, except for dryers, multifamilies
21 or multifamily housing will have higher saturations for
22 those appliances and, as I said, except for dryers.

23 Next slide, please. So now we're going to switch
24 over to looking at the natural gas consumption. And for
25 this one, the trend was that natural gas consumption was

1 actually up 2 percent for homes across the state. But I
2 can see water heating -- compared to the 2009, water
3 heating is still a large part, a portion of the natural gas
4 consumption and, whereas, now space heating has decreased
5 slightly.

6 Next slide, please. So this slide or this table
7 is just showing natural gas UECs and appliance saturation
8 by utility. But mainly we're just looking at the category
9 for all, which is the statewide comparison. So for primary
10 heat we did -- this is where we, again, saw a bigger
11 movement, where in 2009, it was estimated that 83 percent
12 of homes had primary heat. And this is if you have gas
13 connection. Whereas now, in the 2019 results, we're
14 looking at 77 percent saturation. So water heating, again,
15 stayed fairly close with the 2009 saturations, as well as
16 dryers. And then we did see a trend down for natural gas
17 range and ovens from 76 percent in 2009 to 75 percent in
18 the current study.

19 All right, next slide, please. So this slide,
20 it's fairly similar to the last slide, but the results are
21 broken out by home type. And as you can see, across the
22 board, the highlighted appliances again. It was estimated
23 that multifamily natural gas appliances are going to have a
24 lower saturation compared to the single-family homes. But
25 just to focus on the single-family homes, we see that the

1 primary heat saturation is lower at 83 percent for 2019
2 results versus in 2009 the results were 94 percent
3 saturation of homes. So but again, water heating stayed
4 fairly consistent, 95 percent. Natural gas dryers did see
5 some trend down to 53 percent; whereas, in 2009, it was 57
6 percent.

7 So next slide, please. Yeah, so that's just, you
8 know, kind of a quick snapshot of some of the appliances
9 that we have in the -- that were covered by the RASS, but
10 definitely there's a lot more because, like I said, there
11 was 28 electrical and nine natural gas appliances that we
12 have saturations for, as well as UECs. And more
13 information on study or more specific data can be found at
14 the Energy Commission website with the link below. So but
15 currently the final reports are still under review for
16 publication, but they should be published shortly. But
17 it's worth noting that the RASS webtool is live on the
18 website. And I'm excited because it really allows users to
19 more easily sift through the RASS survey response data
20 because it's fairly difficult with 40,000 responses to sift
21 through it all and so the link is also there for users to
22 utilize.

23 Yeah, next slide. And that's it. Yeah, I'm
24 sorry it was so quick, but there's so much to talk about
25 for this study. But I'll be happy to take questions now or

1 later. Thank you.

2 MS. RAITT: Thanks, Le-Huy. With that, I will go
3 ahead and just keep moving on and take some questions
4 later.

5 So next is Panama Bartholomy from -- he's the
6 Executive Director at the Building Decarbonization
7 Coalition. Go ahead, Panama. Thanks.

8 MR. BARTHOLOMY: Great. Thank you, Heather, and
9 thank you, Commissioner McAllister, for hosting this
10 workshop. It's great to be back in the capable hands of
11 Heather and her team, and it's always fantastic to follow a
12 RASS presentation. The new RASS was eagerly anticipated.
13 It's like Christmas within the Building Decarbonization
14 community when the new RASS study comes out, but it only
15 comes every ten years, so fantastic to follow that
16 presentation.

17 Next slide, please. So my name is Panama
18 Bartholomy. I'm the director of an organization called the
19 Building Decarbonization Coalition, and the coalition is a
20 group of energy providers, manufacturers of heating
21 equipment, local governments, the design and construction
22 community, and non-governmental organizations all working
23 together to eliminate pollution from the built environment.
24 I've been asked to come today to give some context for the
25 conversation that you're going to have the rest of the day.

1 The rest of the day you're going to have amazing panels of
2 just some of the leading thinkers and doers within the
3 space, some of the top manufacturers, some of the top
4 consultants, people that are really moving the market
5 forward. And so I was asked to come in and provide some
6 context as well as some, perhaps, policy considerations for
7 the Energy Commission since this is the Integrated Energy
8 Policy Report workshop. So while it is a technical and
9 equipment workshop, I'm going to provide some of the policy
10 context around that.

11 So next slide, please. It's great that the IEPR
12 is focusing on buildings so much this year because
13 obviously if we, as the Commissioner said at the beginning,
14 if we don't solve the problem of emissions from buildings,
15 we don't solve our climate change or our clean energy
16 issues. And the bar chart on the table shows different
17 end-use emissions from different sectors in California and,
18 as you can see, for buildings it's really electricity and
19 natural gas. And for electricity, we have a plan thanks to
20 SB 100, and it's really the yellow bar, the gas, that we
21 don't have a plan for in California.

22 Next slide, please. And this isn't a challenge
23 only for greenhouse gas emissions, but it's increasingly a
24 larger and larger challenge for air quality. This is 2020
25 air quality projections of nitrogen oxides from the power

1 sector, light-duty vehicles or cars and buildings and the
2 burning of gas in buildings, and as we've done a great job
3 on reducing pollution from power plants and cars, we
4 haven't done as good of a job about reducing pollution from
5 burning gas in buildings. And so at this point, burning
6 gas in buildings is producing about five times more smog-
7 causing pollutants than our entire power plant fleet and
8 about twice as much as all of our cars over car crazy
9 California.

10 Next slide, please. The good news is that the
11 California Building Industry Association, the CBIA, put out
12 a report in 2018 that found that we have alternatives to
13 gas appliances. And those alternatives, when you look at
14 it from a new construction perspective, which is the
15 easiest time to build all electric, is those alternatives
16 as electric appliances have similar or lower costs than
17 natural gas appliances for new construction. And so when
18 you combine that with the savings of not putting in gas
19 infrastructure to the building, in the building, and then
20 venting out of the building, you have the opportunity to
21 build emissions-free homes at the same cost or marginally
22 cheaper than if you're building with gas.

23 Next slide, please. In that same seminal year
24 for building decarbonization in California, 2018, E3 did a
25 report looking at the costs of electrification, and they

1 found that for modeled homes within the L.A. region, within
2 the Bay Area, and within SMUD territory, at different rate
3 schedules and different climate zones, that you put in a
4 heat pump for space conditioning and a heat pump for water
5 heating and in all cases for -- those retrofit scenarios it
6 was cost-beneficial to the customer for a combination of
7 those features.

8 Next slide, please. And so it was not
9 surprising, in fact it was quite pleasing, that the 2018
10 IEPR, therefore, laid out the case for building
11 electrification and made it very clear that this is the
12 direction the state needs to go in on buildings and that
13 this is the way that we're going to decarbonize the
14 building stock. Unfortunately, not everybody listens all
15 the time, and so it's great to bring it back in 2021 as a
16 key focus area for the IEPR to make sure that everybody
17 gets the message about moving forward on building
18 electrification.

19 Next slide, please. But the PUC definitely heard
20 the message from the Energy Commission and sees what's
21 happening on the ground and recognized the need to open a
22 proceeding for the long-term planning of the gas network.
23 What you see on this slide is an op-ed that then-PUC
24 Commissioner Randolph wrote in *CalMatters* where -- in which
25 that op-ed she described the proceeding that she opened as

1 the proceeding where the state will plan the transition off
2 of the gas network. And so very clear indication from the
3 two major energy policy agencies in 2018 that the state is
4 going to need to move off of natural gas and we need to
5 start planning for it.

6 Next slide, please. And the good news is it's
7 not rocket science, you know; it's very straightforward.
8 It's four technologies that look very much like the
9 technologies that they're replacing. This makes up about
10 98 percent of natural gas use in California, and it's very
11 simple to replace these technologies.

12 Next slide, please. And it's the simplicity that
13 really leads to the reality that over the last 40 years,
14 over half of all homes built in the United States,
15 according to the U.S. Census -- this slide is from the U.S.
16 Census's American Housing Survey Report -- over half of all
17 homes have been built with all-electric heating -- next
18 slide, please -- and all electric water heating. And so
19 this isn't some crazy *Jetsons/Star Trek* technology. This
20 is the majority of homes built over the last four decades
21 have used all-electric heating within those units as
22 they've been built out across the United States.

23 Next slide, please. But what we have here is a
24 Martha Brook's special. This was lifted from her 2018
25 report and shows the reality on the ground in the existing

1 building stock here in California. And if you look at the
2 water heating represented by the red bar and the space
3 heating represented by the blue bar, this is the saturation
4 of natural gas end uses for water heating and space heating
5 compared to others in homes in California, and homes use
6 two-thirds of all of the gas used in California for
7 buildings. And so you can see the challenge that we have
8 ahead of us if we're to electrify the building stock.

9 Next slide, please. And so the opportunity for
10 existing buildings is really at turnover because there are
11 not a lot of people who are going to proactively retrofit
12 out their water heater or their furnace. You may, with
13 incredibly attractive programs, get to that. But if we're
14 really talking about scaling the market, it's really
15 turnover is the key point we need to be looking at. And
16 the nice thing about this chart is it also allows us to
17 look at timing of our policies and implementing policies
18 that, at turnover, we can start to effect changes and
19 choice. If we're trying to get to carbon neutrality in
20 2045 in California, and you look at the average life of
21 water heaters and space heaters, you can see that it's not
22 much past 2030 or 2035 that we can still be installing gas
23 appliances and expect to be meeting our climate target of
24 carbon neutrality by 2045. And so at some point we're
25 going to have to be implementing policies and ensure we're

1 getting to zero emission installations right around the
2 beginning of the next decade.

3 Next slide, please. And here's what that
4 challenge looks like. This is a chart pulled from the
5 Building Decarbonization Coalition's Roadmap for California
6 Building Decarbonization, and it shows the percentage of
7 sales of different space heating technology moving about a
8 hundred percent being natural gas in 2015, and that if
9 you're moving to 2030 where you're trying to phase out
10 natural gas appliances or emitting appliances for
11 installations, you need to be about a hundred percent high-
12 efficiency heat pump. And that's a pretty steep decline,
13 but not unlike practically all of the steep declines we see
14 for climate change efforts in California and beyond.

15 Next slide, please. Oops. Have we -- has the
16 slide frozen, perhaps? And so to answer the question of
17 how do we go about doing that, that's really why we formed
18 the Building Decarbonization Coalition in 2018. We noticed
19 that there was a lot of different sectors working on
20 building decarbonization, but we weren't working together
21 on it. And so in 2018 Commissioner McAllister helped us
22 kick off the Building Decarbonization Coalition where we
23 brought together 60 different organizations to have a
24 conversation about what are the biggest challenges facing
25 building decarbonization and what are the policy solutions

1 we need -- policy and market solutions -- to be able to get
2 there?

3 Next slide, please. Over the course of the rest
4 of 2018, we held a series of meetings with these groups,
5 again, representing energy providers, manufacturers, the
6 design and construction community, local governments and
7 NGOs, and produced a roadmap to decarbonize California
8 buildings.

9 Next slide, please. And that called for a series
10 of numerical goals in order to be able to completely
11 decarbonize the building stock by 2045. It said that for
12 new buildings we need to be adopting zero emission building
13 codes for residential and commercial buildings and then
14 implementing a series of existing building policies so that
15 by 2045, we've been able to meet the steep ramp of
16 emissions reductions from the existing building stock. On
17 top of that, we recognize that we're going to have to be
18 getting to, right around 2030 or soon after, a hundred
19 percent of sales being zero-emission appliances and we need
20 to transform the market in order to be able to meet those
21 goals.

22 Next slide, please. And so implicit in that is a
23 recognition of where we're at. You know, we are not at a
24 point of mainstream high-efficiency electric appliances.
25 We're really at the phase 1 of this transition, the phase

1 of market readiness. And what we need to focus on right
2 now is really providing clarity to the market, setting
3 targets, aligning our policies, getting the word out that
4 electrification is better, starting to reduce prices, and
5 sending very clear signals to the market about where
6 California's going.

7 Next slide, please. It's only at that point that
8 we can really begin to focus on market deployment. After
9 some of the early adopters and some of the programmatic
10 approaches, we need to be putting in place strong midstream
11 and upstream incentives and financing solutions so that
12 we're able to build off of the policy alignment and the
13 awareness raising to be able to really start to deploy the
14 technology at scale into the market.

15 Next slide. And that's when we can truly be
16 considering about scaling the market and moving you towards
17 more performance-based downstream incentives, really taking
18 advantage of the demand-response opportunities from these
19 technologies and then focusing on those hard-to-reach
20 customers as we get to full saturation of electric
21 appliances.

22 Next slide, please. So a key part of the
23 coalition's efforts were really identifying the major
24 barriers holding back building electrification. We
25 identified about 35 major barriers so, hey, the market's

1 almost there. But we can categorize them into these
2 general five areas.

3 And I'm going to show you the flip side of this
4 if you go to the next slide, please. And we identified
5 these five major goals if we're going to achieve complete
6 building decarbonization in California. We need to
7 dramatically raise awareness in basically all stakeholders:
8 customers, contractors, builders and, no offense,
9 policymakers.

10 We need to ensure that customers are getting a
11 good value proposition from this, not only in capital costs
12 or lowering programs or providing accessible financing, but
13 also, significantly, we need to make sure that retail rates
14 are encouraging customers to make the transition.

15 We need to ensure that building decarbonization
16 is actually a scalable industry for builders and installers
17 so that they can be making money off of this and being able
18 to follow the model of solar in California rather than
19 energy efficiency.

20 We need to make sure that the supply chains are
21 robust and have scaled to be able to meet the demand and
22 that we've sent a clear message to the supply chains so
23 they can make the change in their manufacturing
24 infrastructure to meet our increased demand and that we
25 have done the job to get some of the barriers to the supply

1 chain out of the way, such as a lack of adequate building
2 infrastructure, building electrical infrastructure.

3 And then, lastly, we need to align our policies.
4 Our affordable housing policies, our building code
5 policies, our energy efficiency incentive policies, our
6 refrigerant policies can't be out of alignment with our
7 climate and our clean air policies, and we need to have
8 better alignment among those policies.

9 Next slide, please. So our theory of change
10 really rests on three major tenets about how we can move
11 forward towards decarbonization and meeting those five
12 goals. Number one is really stop digging the hole any
13 deeper. Rocky Mountain Institute has done a study that
14 shows that for every three-year cycle, every three-year
15 code cycle, if we're building out all of those buildings
16 using gas, we're putting about a billion dollars' worth of
17 gas distribution infrastructure into the ground that we
18 know we are going to have to strand over the next 25 years,
19 well before the end of its useful life, the 60- to 80-year
20 useful life. So first and foremost, we need to come to a
21 time where we stop putting new gas infrastructure in the
22 ground.

23 Next slide, please. And then we need to really
24 set a date for the phase out of fossil fuel appliances. We
25 need to be clear to the market about here's where

1 California's going and here's how we are going to work with
2 the market to create the marketplace that can support the
3 eventual phase out of gas appliances. But the sooner that
4 the state can really send the message about when this date
5 is, the better for all actors to be able to start to make
6 the adjustments.

7 Next slide, please. And then, lastly, we need to
8 do significant work building out the building
9 decarbonization market. Electrification has to be a viable
10 alternative to the natural gas market before the first two
11 mandates on this slide are able to be achieved.

12 Conversely, actors within the marketplace aren't going to
13 start to make the transition towards electrification until
14 they have the sort of certainty from the state about what
15 the -- where the state's going and the schedule upon which
16 the state is acting. They're not going to be making the
17 switch to get the training and take part in the programs
18 that are needed in order to make those transitions. So
19 it's a mutually reinforcing theory of change here.

20 Next slide, please. Ultimately, all of this
21 needs to be done under a strong lens of equity and
22 addressing low-income housing first.

23 Next slide, please. Because what we do not want
24 is we do not want a scenario where there is a downward
25 spiral of the gas system in California and who is left on

1 the end of that gas system is low-income households,
2 renters who don't have agency over the choice of their
3 appliances, and restaurants left behind. And so we need to
4 get out ahead of this transition that is already happening
5 by helping low-income households be able to take advantage
6 of some of the programs and the funding that we have
7 available through our budget surplus, as well as potential
8 infrastructure funding to make sure that we are getting
9 those households out in front of this transition.

10 Next slide, please. We work a lot with
11 manufacturers in the space. We work with water heater
12 manufacturers who we've been convening for a few years and
13 we're in wonderful partnerships with. We've convened an
14 HVAC manufacturers group, as well as a kitchen
15 electrification working group. And what we find by and
16 large is that the manufacturers are ready and eager. Now,
17 the good news is that the technologies that we need for
18 decarbonization are being produced. They're being produced
19 right here in America. They're being produced in other
20 countries, brought into America, as well, but they're being
21 produced and we have amazing opportunity around the next
22 industrial revolution, the next electrical revolution being
23 based on wonderful American products and wonderful
24 innovation coming into this country.

25 The challenge is that we haven't created the

1 right political environment to allow that to happen. And
2 when manufacturers look at California, what they see is a
3 haphazard quilt of different local policies that are really
4 fracturing the market and creating different standards in
5 neighboring towns to each other, that we're still heavily
6 subsidizing gas infrastructure here in the state so we're
7 not making the very thing that we're trying to encourage
8 cost-competitive, and that we're not even having
9 coordination amongst the agencies at the state level
10 amongst all the policies. Some of our HVAC manufacturers
11 said that they had to take part in five different
12 proceedings over the last two years in California that
13 affected HVAC technologies. That is in addition to all the
14 other states and the federal activities. And so the more
15 that we can do to be coordinating at the state level our
16 policies and really treating manufacturers as the partners
17 that they are in this process and providing them with
18 transparency, longevity, and consistency, the better we're
19 going to be able to work together to be able to change this
20 market.

21 Next slide, please. I will finish up with some
22 work that we did looking at top 10 policies for California
23 on building decarbonization, and I'll leave you with this.
24 This is just a very -- this is a eye test chart just to
25 show you some of the level of analysis we did on about 40

1 different policies -- next slide, please -- and then
2 identifying the top 10 policies and really looking at it
3 from this perspective. Greenhouse gas mitigation
4 potential, economic impact, its effect on equity, political
5 barriers to adoption, legal barriers, and then how complex
6 it would be to implement. And out of that we will have the
7 following ten policies.

8 Next slide, please. So this is just a
9 beautifully formatted -- my comms (ph.) team would kill me
10 for putting this in, but I'm just going to briefly go
11 through each of these and we'll finish on time here.

12 So next slide, please. Number one is really
13 sending that clear market signal to manufacturers and the
14 rest of the supply chain. They are begging to know where
15 California's going, on what schedule, what are we trying to
16 achieve? And so having from the upper levels of state
17 government providing a really clear message is the number
18 one thing that we need in this space right now and for the
19 agencies to have adopting targets for building
20 decarbonization and then starting to implement policies in
21 partnership with industry on being able to make this
22 happen.

23 Next slide, please. Second is ensuring that once
24 people electrify, that they're at least going to be held
25 harmless, if not really rewarded, for electrifying through

1 rate reform that can lead us towards the types of rates
2 that encourage electrification. This is not going to work
3 if people find themselves in situations where they're
4 unhappy after they've electrified and they have higher
5 bills. And so part of this will be education about how to
6 best use electricity, but part will also be very much about
7 how to get the right rates to be able to support
8 electrification.

9 Next slide, please. Number three is that
10 investment in underserved communities and low-income
11 housing. We have the best building decarbonization program
12 in the country here in California. The Low-Income
13 Weatherization Program whose multifamily part of that
14 program is averaging a 60 percent reduction, greenhouse gas
15 reduction, per unit that they retrofit is by far the best
16 program in the country serving low-income multifamily
17 housing here in California. We need to significantly
18 invest in that program. It's great to see the governor
19 propose \$50 million for that program in the May revise, but
20 as programs like that -- and hopefully that can be a
21 vehicle for any infrastructure funds that come down for
22 energy efficiency and electrification, as well. But we
23 need to be investing in low-income housing so that those
24 low-income households are able to make the transition at
25 the same or faster rate as moderate and higher income

1 households in California as we start to get down the
2 spectrum of transition.

3 Next slide, please. We need to update the state
4 building code to require all electric new construction.
5 This is the easiest time to do electrification. This is
6 our opportunity to build significant market share for these
7 technologies, to expose installers to how to install these
8 technologies, and to expose consumers to how wonderful
9 these technologies are and how they won't even notice them
10 except for the induction stove which will blow their mind
11 when they start actually cooking on it. I'll miss the
12 Warren-Alquist building, but look forward to future
13 workshops in the new headquarters for the Energy
14 Commission.

15 Next slide, please. And then we need to find a
16 way to be eliminating subsidies for new fossil fuel
17 infrastructure. Right now in California we subsidize --
18 rate payers subsidize fossil fuel infrastructure that goes
19 to all new buildings through line extension allowances.
20 And so California has to make the decision about putting
21 ratepayer funds into the very infrastructure that's making
22 it a challenge to meet their clean energy and climate
23 goals. And so eliminating the subsidies are going to be
24 critical and one of the most impactful things the state can
25 do in order to be able to encourage building

1 decarbonization.

2 Next slide, please. Recognizing the impact of
3 air quality. One of my early slides showed how buildings
4 are starting to have an outsized impact on air quality as
5 we make great progress on the electricity sector and on the
6 vehicle sector. And so starting to recognize those
7 benefits in our program implementation, whether that be
8 incentive programs or regulatory programs, will start to
9 incentivize and start to require some of the very measures
10 we need to move towards building decarbonization and
11 provide widespread community immediate benefit in those
12 airsheds as well.

13 Next slide, please. And then the state can have
14 amazing power itself. The Department of General Services
15 has the second largest real estate portfolio in the country
16 and the second largest procurement program in the country,
17 making a commitment to the state's own buildings to be
18 building all electric where feasible and using that amazing
19 purchasing power to create master contracts that local
20 governments, local housing agencies, local school districts
21 can then access -- will be able to give access to lower-
22 cost all-electric appliances for those entities and as a
23 way for the state to really use its power to begin to lower
24 costs.

25 Next slide, please. And then sending a clear

1 message out to the market about when California is going to
2 phase out fossil fuel appliances. I mean, we've been
3 talking about it for years now. It's no secret that this
4 is the direction the state is going in. But what is a
5 secret is the schedule, the standards, and the date, and so
6 the state needs to be clear about where it's going and when
7 it's going there.

8 Next slide, please. And thank you, Stephanie.
9 I'm getting your messages. It's the last three slides.

10 And then developing a plan for phasing out
11 utility gas infrastructure. This is where conversations
12 around just transitions, not only for workers, but also
13 communities, come into play. We need a very public forum
14 to be able to have a discussion about how we're going to be
15 doing this and how we're going to be equitably electrifying
16 in neighborhoods as we're winding down the gas system. And
17 so there's an increased body of work looking at overlays of
18 demographic and environmental impacts, like
19 CalEnviroScreen, with distribution systems and the age of
20 distribution systems and affordable housing developments
21 that we can use to prioritize equitable electrification as
22 we wind down and retire gas systems in those areas. But we
23 need to really get on this planning so that we can do this
24 in a whole neighborhood area rather than an appliance-by-
25 appliance approach.

1 Next slide. And then, lastly, we need to stop
2 state support for fossil fuel infrastructure expansion
3 through our construction programs. We're investing over \$5
4 billion into affordable housing. We invest billions of
5 dollars a year that's matched by billions more into school
6 construction, and if we do not have policies in place that
7 are ensuring those are all electric, then we have policies
8 in place that are ensuring those will be built with natural
9 gas. And therefore, we are putting in the case of
10 affordable housing development, vulnerable communities with
11 assets that we know are going to be stranded and require
12 expensive upgrades before the end of the useful life of
13 those assets and potentially the useful life of those
14 appliances. And so those are the very communities we can
15 least afford to be burdening with that, and so we need to
16 make sure that our ratepayer dollars, our taxpayer dollars
17 are not being spent on exacerbating our clean energy, our
18 clean air, and our climate change difficulties in
19 California.

20 Last slide. Last few slides. So New York has
21 already been making this transition. Next slide. They
22 have committed that by 2025 an all-electric code and by
23 2030 beginning the phase out of gas appliances.

24 Next slide, please. This is not my title of the
25 slide. This is the title from a presentation given last

1 week by NYSEERDA about the -- New York's plan for building
2 decarbonization, and they're making very clear that
3 regulations with date certain send clear market signals.
4 And this is what the market is asking for and is asking for
5 from California.

6 So, last slide, please. So, in summary, we know
7 that building electrification is going to be the only way
8 we meet our clean air and clean energy goals. The
9 technology is already available and being made right here
10 in the United States. It's cheaper to build this way and
11 it can save consumers significant money on a monthly basis
12 on their bills. But the state needs to provide clear
13 timelines and targets about where it's going in order for
14 the market to be able to transition -- and all the
15 wonderful speakers you're going to hear from -- to be able
16 to bring their expertise to bear. And then we really must
17 address low-income households as a priority in this
18 transition so that we're making sure they're carried along
19 at the same or faster rate as moderate and higher income
20 households.

21 So thank you for having us. We look forward to
22 the rest of the discussion today and helping the Energy
23 Commission with the IEPR.

24 MS. RAITT: Thank you, Panama.

25 Commissioners, did you have some questions?

1 COMMISSIONER McALLISTER: Let's -- yeah.

2 MS. RAITT: Commissioner Monahan has joined too.

3 COMMISSIONER McALLISTER: Great. Yes, great. So
4 I wanted to just welcome Commissioner Monahan. And
5 certainly let us know if you have questions on anything
6 that you've heard. I know you had to come in partway
7 through, but, yeah, welcome and thanks for being with us.

8 Thanks to the three speakers for your
9 presentations. Really good stuff. Nice to hear the two
10 different divisions working on these issues. The RASS,
11 obviously, definitely agree with Panama, that's a nice
12 present that we get every decade or so. And this one, I
13 think, is interesting in particular because it's starting
14 to move us in a more digital kind of approach and starting
15 to use new tools to gather information in addition to sort
16 of historically relevant survey techniques.

17 Let's see. And then, Michael, thanks for the
18 overview at the outset. Panama, thanks for really digging
19 in to all of these issues. I know, you know, every time I
20 see your presentation, your intro slide with all your
21 members gets to be more of an eye chart, and that's
22 positive progress, so thanks for that. Really amazing
23 success just getting industry and local government and all
24 the different partners aligned there and working together
25 on these issues. I did want to sort of -- I wanted to ask

1 you, Panama, specifically -- you know, absolutely
2 appreciate the role of the state. And as you know, we try
3 to be -- we try to use our authorities in a -- the Energy
4 Commission tries to use its authority in the most sort of
5 strategic way possible, you know, when we have the
6 authority, and that is really what's needed. We try to use
7 it to its greatest effect and be strategic about that.
8 Yeah, you mentioned a lot in your presentation, you know,
9 quote, unquote, the state. And so I think that sort of
10 speaks from a different era of centralized government, and
11 so -- and indeed, you know, we're moving from our Soviet-
12 era building into a new, modern LEED platinum high rise, in
13 Sacramento, we're all very excited about that.

14 I guess I would encourage you to be more
15 specific. And certainly we have building -- we have part 6
16 authority, part 11 authority, but there are many
17 authorities, both within the building code and outside the
18 building code, that have to do with appliances, that have
19 to do with air quality, and sort of other levers that have
20 to do with pollution, both at the local, regional, and
21 state level. And I guess I'm wanting a little more of a
22 strategic viewpoint of how you think that conversation can
23 be shaped both at those government levels with those
24 government entities, together with local and regional
25 partners out there in the marketplace. Because I think

1 that the sum total is really what's going to get this job
2 done, and we have to make sure that our authorities are
3 actually well -- you know, the actions that are taken are
4 actually well within each respective authority. And so
5 that obviously includes part 6. Part 11 is from the Energy
6 Commission, but it includes all of those other efforts
7 across state and local government. So I guess a little
8 more nuance about that strategy, sort of at least
9 conceptually about the strategic approach that you're
10 thinking would be helpful.

11 MR. BARTHOLOMY: Absolutely, Commissioner. Thank
12 you for that. And good to see you, Commissioner Monahan,
13 as well. So if you work in climate change, you know that
14 it's a faith-based initiative. You've got to have faith
15 because the numbers are daunting. And I have faith that
16 the state agencies with your expertise amongst you and the
17 authorities that are embedded in each of you are going to
18 be able to come together over the next few years and be
19 able to figure out what that wonderful mix of authorities
20 are needed and actions are needed to be able to achieve
21 some of the targets that I had in my presentation. Some of
22 that's going to be at the Energy Commission, some of that's
23 going to be in other agencies, but what we really need is
24 we need the -- we need quick action from across the state,
25 and we need it in a coordinated way.

1 Local governments can play their part to a
2 certain extent, I would say, Commissioner, but they are
3 inherently ill-placed to be able to address the issue of
4 existing buildings, I would say. It is one thing -- and we
5 can have arguments, and I think you will, from some of the
6 panels about the benefits of local governments adopting
7 reach codes on new construction. That is not politically
8 challenging, by and large, for local governments,
9 particularly in northern California because you don't have
10 hordes of potential future homebuyers coming in and posting
11 up at city council meetings. Once you start getting into
12 issues of dictating choice on appliances for retrofits,
13 that's a whole 'nother -- that's a whole 'nother ball of
14 wax for local governments that are exposed more directly to
15 voters, and it can be a challenge to have something as
16 existential as climate change and regional air quality be
17 used as a justification at the local level for an existing
18 buildings policy. And so inherently, the higher up the
19 level of government, the better for existing building
20 policies.

21 But I think a combination of incentives with
22 ratepayer dollars from the Public Utilities Commission and
23 then the air quality and greenhouse gas authority of the
24 Air Board mixed with the part 6 and part 11 authority of
25 the Energy Commission can produce exactly that wonderful

1 soup of leadership that we need in order to be able to meet
2 the targets.

3 COMMISSIONER McALLISTER: Thanks a lot for that,
4 Panama. And, you know, I agree with your answer. And I
5 would say we are working with that -- not only working in
6 that direction, but not only with the two agencies you
7 mentioned, but also with the various agencies that have to
8 do with actually housing and industrial policy in the
9 state. So there's increasing coordination across those
10 agencies and with the Governor's office.

11 I guess the other -- maybe it's more of a comment
12 than a question, but I think at the local level you said
13 folks are exposed to voters very directly. Well, I think
14 that also does play at the state level, so I would
15 encourage you to begin to -- I mean you said, you know, the
16 market -- actually, readiness is not actually there. The
17 market readiness is not actually there to sort of do it
18 today, so there's a market kind of -- we -- typically,
19 mandates come once it's sort of almost a done deal in the
20 marketplace.

21 So here we're talking about really forcing -- you
22 know, doing some technology forcing at some level with the
23 various authorities in the state to get that rapid change.
24 And so I think that does require political will, and so the
25 state agencies and our action is absolutely influenced by

1 voter accountability, as well, via the legislature. And so
2 I want to just -- you know, getting out ahead of where our
3 elected officials want to go we kind of do at our peril,
4 and it's always helpful to have a handshake there so that
5 we can focus on the task at hand and get it done. So it
6 helps to -- you know, I would just encourage you and your
7 members to think about how to create the space for that
8 conversation to happen in an expeditious way because we
9 absolutely have to work with the legislature to get to yes
10 on this issue. And so I want to just point that out, so
11 not really a question but more of a comment.

12 And I wanted to ask Commissioner Monahan if she
13 actually had any comments or questions. And then we also
14 want to see if we have questions from the attendees.

15 COMMISSIONER MONAHAN: Yeah. Well, thanks,
16 everybody. I'm sorry I popped in late, and I'm going to be
17 popping in and out throughout the day because I have some
18 other engagements.

19 I had a question for you, Panama, which is
20 around -- you started to answer it with what you said about
21 New York leading. Are there other states or other
22 governments across the globe that we should look to for
23 leadership and learning?

24 MR. BARTHOLOMY: Yeah. Thank you, Commissioner
25 Monahan. Absolutely. So the states of Colorado, Nevada,

1 New Jersey, Connecticut, and Maine, and the state of
2 Washington are really leading these areas, and those are --
3 and Massachusetts. And those are a combination of states
4 that have either adopted a building decarbonization roadmap
5 at the executive level or have legislation that is passed
6 that is put in place, building decarbonization policies.
7 And so we have this wonderful mix of different states that
8 are starting to take action, and I think the opportunity
9 for California to partner and provide some leadership à la
10 the tailpipe standards and start to find ways to really
11 harmonize schedules and standards which is really what the
12 market needs, you know, as wide of a marketplace as
13 possible having similar schedules and standards is really
14 what is needed to scale the market.

15 On the international side, many European
16 countries are starting the phase out of gas appliances,
17 mostly in new construction, but they are -- the European
18 Union right now is updating their appliance standards for
19 furnaces, and there is an effort underway to push them
20 towards zero emission heating for European countries. But
21 the UK, Netherlands, Germany, and Sweden are all leading on
22 phase out. I'd be happy to give your office more
23 information on those policies.

24 COMMISSIONER MONAHAN: Great. Thank you. Yeah,
25 maybe we could follow up, Panama, with a discussion about

1 this because I'd really like to see how we can learn from
2 others and how others can learn from us.

3 COMMISSIONER McALLISTER: That's a great point.
4 We do actually have that collaboration with the EU and with
5 Denmark, Germany that actually is looking at these issues,
6 as well, so there is a channel for that already,
7 Commissioner, so absolutely. I guess --

8 COMMISSIONER MONAHAN: Oh, can I ask one last
9 question in the international context? And maybe this is
10 for you, Commissioner McAllister, but really is this
11 part -- I mean, in the costs are you anticipating any
12 commitments that will be brought to light from the building
13 decarb?

14 COMMISSIONER McALLISTER: I'm sorry, I didn't
15 understand that. I just had a little --

16 COMMISSIONER MONAHAN: At the Council of Parties,
17 at the next international climate negotiation, do you
18 envision building decarb being part of the commitments that
19 are going to be made public?

20 COMMISSIONER McALLISTER: So the last one -- so
21 those conversations absolutely already exist and there
22 is -- around every clean energy ministerial and every COP
23 there's sort of a new flight of -- or, you know, group of
24 commitments. So, yeah, I absolutely would anticipate those
25 getting updated. And since the last COP, you know,

1 building electrification really has emerged as the strategy
2 for decarbonizing our buildings and it's ever widening to
3 ag and industry and across the board, really. And now, as
4 you know better than I, it's also emerging with the
5 transportation discussion. So absolutely I think that will
6 be a central theme in the COP.

7 But maybe, Panama, you have some insight on that,
8 as well.

9 MR. BARTHOLOMY: Yeah, indeed. There are a
10 number of groups, Commissioner Monahan, that are coming
11 together across the world that are working on buildings and
12 building heating issues and trying to see if there's an
13 early conversation that can happen in Glasgow around a
14 global coalition to address heating and probably something
15 that would then be formalized at the next COP after that.
16 But, as usual, Ed Mazria from Architecture 2030 is right in
17 the middle of it, and he's hosting a three-day buildings
18 summit the week before the Glasgow COP in London in order
19 to prepare all those groups for the meetings.

20 COMMISSIONER McALLISTER: Great. So I could go
21 on asking questions for quite a while, but I will not do
22 that and open it up for attendees to ask any questions.

23 Heather, can you --

24 MS. RAITT: Yeah, thank you.

25 COMMISSIONER McALLISTER: Or maybe it's Kristy

1 who's going to moderate the questions?

2 MS. RAITT: Yeah, Kristy, if you could briefly go
3 read a question or two?

4 MS. CHEW: Yes, hi. There are two questions.
5 One was from Shraddha Mutyal. I apologize for the
6 pronunciation. I believe it's for Michael, for his
7 presentation. There was a question: The range/cooking
8 includes electric resistance stove too, correct?

9 MR. BARTHOLOMY: I think that was for Le-Huy.

10 MR. NGUYEN: Yeah, I think that might be for me.
11 Yes, so in the -- for the end-use range cooking it does
12 include electric resistant stoves for the electrical end
13 uses.

14 MS. CHEW: Great, thank you. Second question was
15 from Alice Sung. Building decarbonization is needed in all
16 buildings, and for low income and renters, but don't we
17 need to make sure that we don't leave our "children's
18 houses" -- our pre-schools, day cares, and public preK
19 schools behind as well as we decarbonize buildings?
20 Especially those same children whose homes and schools are
21 in the most impacted communities and Title I eligible, in
22 schools with failing gas heating systems and that need
23 kitchen upgrades -- how will we make sure that they benefit
24 FIRST?

25 MR. BARTHOLOMY: Agreed. I cannot argue with

1 that. I would say that, you know, there's an increasing
2 body of research, particularly around cooking and the
3 impacts of cooking with gas and its impact on children's
4 both near-term and long-term lung health that is very
5 troubling, and that's why it's very encouraging that the
6 Energy Commission is looking at differentiated ventilation
7 standards under the 2022 building code for homes built with
8 gas stoves versus homes built with electric stoves. A
9 study that came out of Australia just last month stated
10 that living in a home with a gas stove for a child is the
11 equivalent of living with a cigarette smoker in the home
12 from a lung health perspective. So it's great to see the
13 Energy Commission taking leadership. I think it will be
14 the first code in the nation to recognize some of the
15 dangers of cooking with gas and trying to address it. And
16 then that plays, as well, into schools and daycare centers.

17 COMMISSIONER McALLISTER: I just want to thank
18 Alice for that question. And, you know, Alice, you're a
19 stalwart on the school's front. We really appreciate you.
20 And you probably know, but I'll just say for the record
21 that the 841 program will be focusing on existing schools
22 in disadvantaged communities to improve air quality and
23 install CO2 sensors, monitors, in those schools. So, as
24 usual, it's not enough money to do the whole job across the
25 whole state. We have a massively large state.

1 And I want to just segue to an exhortation among
2 Panama and your members and also our speakers from outside
3 the Commission who will help us grapple with this issue
4 today. The more specific numbers we can have about the
5 scale of this challenge and specifically how much capital
6 is going to be required -- you know, we can do back of the
7 envelope, you know, pretty easily and get to the many tens
8 of billions of dollars it will take to upgrade our existing
9 building stock. And then compare that to the available
10 funds today and it's only a very small percentage that we
11 actually have access to or have a visual of. So in SB 100
12 the report -- it has to be the first SB 100 report --
13 established some numbers for the build rate that is needed
14 from every year from here to 2030, 2045, to help us get a
15 sense of what kind of scale relative to the current
16 marketplace, the current project flow. And that was a real
17 wakeup call. We have to build every year essentially the
18 equivalent of the single greatest solar implementation year
19 for every year going forward to 2040, basically. So we
20 need -- and we can do it in this IEPR, and I think we want
21 to have that discussion. What does that build rate look
22 like? And it's more complex. It's a much more fragmented
23 marketplace for building upgrades, you know, all these
24 challenges that you all know better than we do. I think
25 have an appreciation of that build rate and what kind of

1 capital flows it will require and begin to really detail
2 what that's going to look like. That really is the kind of
3 strategy that we need as a state and to be able to distill
4 that down for our decision makers, our elected officials in
5 the state, to really kind of put that on the table: Here's
6 what this would look like in practice. And so that's the
7 workforce, that's the equity piece has to be front and
8 center. Where is that capital coming from and where is it
9 going and what those incentives are.

10 So anyway, I wanted to just use my bully pulpit
11 again to ask -- to kind of direct the conversation to the
12 extent that we can to those really key important policy
13 issues as we also talk through the technical issues today
14 and then move on to the other workshops down the road this
15 summer.

16 So with that, I'm getting the signal from Heather
17 that we need to move on. But hopefully, Panama, you can
18 stick around and participate in the discussion going
19 forward today and we'll look forward to our next panel. So
20 we're about -- we're about nine minutes, I think, behind
21 our formal schedule here, but I think this was really
22 valuable discussion to kick things off, so thanks to our
23 three speakers.

24 And back to you, Heather.

25 MS. RAITT: Great. Thank you. And thanks again,

1 yes, to Michael and Le-Huy and Panama. Really appreciate
2 those opening presentations.

3 So our first panel is on the manufacturer and
4 supply side perspectives, and Gabriel Taylor is the
5 moderator, so go ahead, Gabriel.

6 MR. TAYLOR: Good morning. Thank you, Heather.
7 And thank you to the speakers thus far and the
8 Commissioners for that foundation and framing.

9 Today's workshop is focused on equipment and
10 manufacturer perspective, and we have three panels today.
11 The first panel is focused on the supply side perspective,
12 the second panel will be focused on the demand side
13 perspective, and then our final panel today will be focused
14 on the R&D and the future, where the technology is leading
15 us.

16 So for the first panel, the first speaker I'd
17 like to introduce is Ralph DiNola, the CEO at the New
18 Buildings Institute. Ralph?

19 MR. DiNOLA: Good morning, and thank you,
20 Gabriel. Thank you, Commissioner McAllister, for hosting
21 this workshop and Commissioner Monahan for being here, as
22 well. And I'd say the only thing better than following the
23 RASS presentation is following Panama. But Michael, Le-Huy
24 and Panama, thanks for great presentations to set the
25 context for this discussion.

1 So this morning I'm going to share about the
2 Advanced Water Heating Initiative and give you an
3 orientation. But to start with, a little context about New
4 Buildings Institute.

5 Next slide, please. So New Buildings Institute
6 is a California-based nonprofit. We've been operating for
7 more than 23 years, and we envision a transformed built
8 environment that is carbon-free, sustainable, energy-
9 efficient and supports a thriving economy and benefits all
10 people and the planet.

11 So our mission has been to really drive
12 transformation in the building sector at large across the
13 U.S. and now with some international engagement, so we're
14 really thrilled to have this opportunity to speak with you
15 today.

16 Next slide. Over the past several years we've
17 been focused on building decarbonization. We've completed
18 this report about building electrification technologies
19 with the IOUs in California. Recent report -- we have been
20 driving this Advanced Water Heating Initiative really
21 convening first in California and then a west coast
22 initiative and now national, so I'll talk a little more
23 about that. And then we've been really focused on how we
24 integrate decarbonization into codes, and so we've been
25 working on reach codes in California and other states and

1 cities across the country, and also have been supporting
2 the building decarbonization roadmap and electrification
3 roadmap for NYSERDA that Panama mentioned earlier.

4 Next slide, please. So the Advanced Water
5 Heating Initiative is an initiative that actually started
6 in California in partnership with the Building
7 Decarbonization Coalition with the retrofit-ready heat pump
8 water heater summit that was held in 2018, really
9 recognizing that water heating is, as we saw, one of the
10 most important end uses in California in terms of
11 decarbonization. So why heat pump water heaters?

12 Let's go to the next slide. So as we saw, I
13 think, with the RASS study that we know that California is
14 unique across all regions of the country in that between
15 natural gas and propane, about 90 percent of water heating
16 is fueled by fossil fuels. And with somewhere between 13-
17 and-a-half, 14 million units in the state, that is a
18 significant opportunity for decarbonization, and that is
19 why we're so focused on this. I think it was interesting
20 to note that between 2009 and 2019 gas consumption for
21 water heating jumped from 48 percent of gas use to 59
22 percent.

23 Next slide. So this initiative has been running
24 as a west coast initiative. We've also been working with
25 the Midwest Building Decarbonization Coalition in the

1 Midwest region, and now are expanding this to be a national
2 collaboration. We are in discussions with the U.S.
3 Department of Energy, with EPA, and also with the CEC about
4 partnership around this initiative as it expands
5 nationally. So our core partners as we launch this
6 initiative have been with us and supporting us and we're
7 growing.

8 Next slide, please. We're growing this into, you
9 know, beyond the west coast initiative into a national
10 initiative.

11 Next slide, please. So you can see kind of
12 similar expansion in terms of partnerships, and these
13 members are joining us. We have over 50 organizations and
14 at least 100 participants in the initiative now, and we are
15 expanding, so look forward to having others join us.

16 Next slide. And we are very excited to share
17 that in May, at the Better Buildings and Better Plants
18 Summit, the U.S. DOE and a White House panel has basically
19 recognized the Advanced Water Heating Initiative as an
20 initiative they would like to support to focus on the
21 market transformation effort nationally of water heating
22 transitioning from electric resistance and gas water
23 heating to heat pump water heaters.

24 Next slide. Thank you. And so the market sector
25 focus of the initiative, we are looking at residential and

1 commercial, and a goal similar to the Building
2 Decarbonization Coalition, 100 percent of market share by
3 2030, 100 percent of sales, and with commercial 90 percent
4 of multifamily new construction by 2026. Two key markets
5 in California and, again, these goals align with the goals
6 of the state for this needed decarbonization effort.

7 Next slide. So we see basically four key
8 strategies for market transformation. We want to have the
9 technology in every building type. So the heat pump water
10 heaters are currently available, the technology is
11 available, all efficient and available in the market. We
12 want to create expertise in the supply chain, throughout
13 the supply chain, and have programs and policies working
14 together as we were just talking about earlier. And then
15 we really need to drive consumer demand for these
16 technologies, as well. All of this is, of course, key that
17 it is centered on affordability and equity to align with
18 the goals of the state.

19 Next slide, please. So the focus thus far with
20 the initiative for the past two years has been driven by
21 four working groups. These are volunteer working groups
22 that have been focused on these specific technologies. The
23 240 volt heat pump water heater, we developed a playbook
24 and also a rapid deployment guide for the market.

25 The 120 volt, which is a new technology that

1 really rose out of that retrofit-ready summit, there are
2 currently four manufacturers and seven products that are
3 either in the market or coming to market. This will be a
4 game changer for the retrofit market, and we're very
5 excited about that technology.

6 Central is commercial technology, and so this is
7 basically a recognition that built up systems are
8 complicated and don't always operate as well as a
9 manufacturer-based package system. So there's new five
10 manufacturers that are developing these packaged or skid-
11 mounted central heat pump water heaters for the market.
12 And there are tools that are available to size and model
13 that technology.

14 And really importantly, and I think Commissioner
15 McAllister, definitely with your load management standard
16 and efforts, the focus on connectivity and control in grid
17 interactive water heating, so the CTA-2045 and the JA13
18 integration in California is also key.

19 Next, please. So part of this rapid deployment
20 we recognize three initial pathways. One is we need to
21 basically get heat pump water heaters into all new
22 construction as rapidly as possible. This would be single
23 family and multifamily new construction. It is the easiest
24 approach, and it is cost-effective, and so this is
25 something we can move quickly to do. And then moving to

1 electric resistance water heaters and addressing those,
2 even though they're a small number by percentage, they're a
3 large number in the state. And then replacing existing gas
4 with 240 volt and 120 volt.

5 Next, please. So to achieve these goals and
6 thinking about the overall market in California, we need to
7 ramp up on those three different pathways in the
8 installation of the new construction 240 volt, the electric
9 resistance replacement, about 60,000 units a year, and then
10 the gas replacement. And the challenge here is we
11 recognize that market penetration across the country is not
12 significant and especially in the state of California, so
13 we really need to ramp up the market penetration to get to
14 those numbers.

15 Next slide. As Panama mentioned, the patchwork
16 quilt of programs and policies related to decarbonization
17 and electrification and specifically heat pump water
18 heaters is, I think, recognized by most, but I think there
19 are many different approaches that are finally coming to
20 the market. The SB 1477 with the TECH program now on the
21 street and the BUILD program underway in development and
22 the SGIP program that there is market transformation is now
23 coming to the state of California. Also, the market
24 transformation administrator opportunity is coming up, as
25 well, so this patchwork quilt hopefully will have fewer

1 squares and more alignment as we go.

2 Next slide. And I'm going to share that, you
3 know, there is an overall program framework that has been
4 developed as part of the initiative that people can
5 reference later in the slide deck.

6 Next slide. The most important, I think, game-
7 changing technology that should be discussed -- and other
8 panelists will talk about this as well -- is this 120 volt
9 plug-in heat pump water heater. This is a new product in
10 the market. Really essential for retrofit and the
11 opportunity to do cost-effective retrofit without having to
12 do panel upgrades or running new lines. And so there are
13 products that are in the market now and coming to market,
14 and we are working on a field study so that work papers can
15 be developed to integrate these into California incentive
16 programs.

17 Next slide, please. We're also involved in this
18 EPIC low GWP central heat pump water heater study, so this
19 is underway. Currently working on that with this team, and
20 so we'll have more results around central and low GWP
21 technologies.

22 Next slide, please. So I think, you know,
23 thinking about the entire supply chain, we know that there
24 are intervention points. There's intervention points with
25 the manufacturers and especially with installers, plumbers

1 and contractors. And then how do we address homeowners?

2 So next slide, please. So thinking about kind of
3 the scale and numbers, you can see that with fewer than 15
4 manufacturers, it may be easier to work more closely with
5 manufacturers than the end users. And so there's two
6 different approaches, again, along the whole supply chain,
7 but you can see the kind of difference of scale and where
8 intervention may make more sense in terms of trying to get
9 traction. So we are looking at all of the different
10 players along the supply chain and understanding what
11 leverage there is with those different actors.

12 Next slide, please. And really it comes down to
13 three things, we believe, for market transformation:
14 building confidence, reducing costs, and increasing
15 capacity. So let's just look at those quickly.

16 Next slide, please. So in terms of building
17 confidence, we need to promote these consumer campaigns.
18 "The Switch Is On" is something co-developed with Building
19 Decarbonization Coalition, and we believe that these kinds
20 of campaigns can start to influence consumers.

21 Next slide, please. We need to work on cost.
22 You know, the first cost is a barrier. We know that there
23 are incentive programs that are trying to drive that cost
24 down. We also want to work with manufacturers to see how
25 we can drive costs down. You know, these examples of a

1 water heater and an air conditioner or a refrigerator
2 demonstrate that these technologies can be lower cost right
3 now and competitive with electric resistance and gas water
4 heaters.

5 Next slide, please. And we also recognize that
6 we need to reduce operating costs through rate reform, new
7 rate design, and also grid interactive water heating. So
8 water heaters in California should be grid-connected in
9 order to reduce costs and benefit the renewable grid.

10 Next slide, please. And we also want to support
11 production and modernization in manufacturing and building
12 capacity to get these products to market. Right now, the
13 heat pump water heaters are a sideline and they need to be
14 in the mainline in manufacturing.

15 Next slide. And I'll work on wrapping up here.
16 Just, lastly, some feedback from manufacturers when asked
17 what are some of the things that they consider important
18 for programs as they move forward. And so, again, because
19 this panel is about technology and the supply chain and
20 manufacturing, these are some offers to the Advanced Water
21 Heating Initiative from manufacturers just suggesting how
22 we can work on market transformation to support the
23 development of the market, and I think that might be on my
24 last slide.

25 Thank you, next slide, please. So, again,

1 nationally, thinking about how heat pump water heaters
2 alone, focusing on water heating, can really save hundreds
3 of millions of tons of carbon every year, especially in the
4 state of California.

5 Next slide. And we welcome those listening on
6 the call to join the initiative. And I think my final
7 slide. Thank you very much for the opportunity. Again,
8 thank you, Commissioner McAllister, Commissioner Monahan,
9 Gabe, thank you, and Commission staff, for this
10 opportunity.

11 MR. TAYLOR: Thank you so much, Ralph. We really
12 appreciate all these efforts.

13 Now I'd like to introduce Helen Walter-Terrinoni,
14 the Vice President of Regulatory Affairs at AHRI, the Air-
15 Conditioning, Heating, and Refrigeration Institute. Helen?

16 MS. WALTER-TERRINONI: Thank you, Gabriel,
17 appreciate it. And thank you so much for including me in
18 this discussion today. Just to introduce AHRI, the Air-
19 Conditioning, Heating, and Refrigeration Institute
20 represents more than 90 percent of the heating,
21 ventilation, air conditioning, refrigeration, and water
22 heating equipment manufacturers. Of course, that equipment
23 provides critical cooling and heating from living-saving
24 climate control to equipment for cold chain for both food
25 and vaccines. We also convene a diverse group of

1 stakeholders to develop consensus standards related to
2 energy efficiency, as well as demand response for water
3 heaters, which we're going to talk a little bit more about
4 today.

5 Our members have worked tirelessly to lean into
6 climate regulations globally, nationally, and at the state
7 and local level through energy efficiency improvements as
8 well as in supporting the American Innovation and
9 Manufacturing Act, which phases down short-lived climate
10 pollutant, hydrofluorocarbons, HFCs, which you've heard
11 some discussion about already today and will probably hear
12 some more about in future sessions because they have an
13 oversized benefit and can reduce global temperature
14 increases by as much as a half percent by 2100. This joint
15 effort between nongovernmental organizations, NGOs, and
16 industry has been hailed in the press as a unique
17 cooperation to move climate policy forward, and we
18 certainly hope to see more of this as we continue our
19 greenhouse gas journey together.

20 Just like with HFCs, one of the key things that
21 we worked through from the HFC side of things, it's
22 important that we examine and address challenges to next
23 steps regarding greenhouse gases so that substantive
24 benefits can be achieved.

25 Some of these topics were discussed a little bit

1 earlier, but I will go ahead and mention some of these so
2 that we can kind of keep these in front of us. These are
3 the kind of pitfalls that can sideline good-meaning efforts
4 and need to be considered. So the first thing is that we
5 need to ensure that critical services are provided such as
6 life-saving climate control in hospitals, schools, homes,
7 and elder care facilities, as well as cold chains for food
8 and vaccines, as well as critical water heating for homes,
9 schools, and elder care facilities. We need to make sure
10 that we minimize disruptions to the overall supply chain
11 and to these critical services. Disappointment and
12 disruptions can often fall to manufacturers, so we're
13 particularly sensitive to those and want to make sure that
14 these issues are addressed ahead of time.

15 We've talked about some of these things up front.
16 I live in upstate New York, and grid stability is
17 problematic here. I live in a rural area and there's a
18 propane tank at every house because of the need for
19 generators because of lack of stability to the grid. So
20 challenges like that, challenges like equity issues for new
21 equipment installed in existing buildings -- we've heard a
22 little bit about that earlier -- especially in urban and
23 underserved rural areas that may be difficult and costly to
24 retrofit. Some examples include, you know, areas where the
25 architecture including ductwork in units installed in tight

1 locations and it may be difficult and challenging to
2 retrofit those, and costly.

3 There's a need to explore the greenhouse gas
4 footprint by zoning grid, and in some cases there can be
5 issues for, again, rural and underserved urban communities.

6 There are some updates needed for buildings to be
7 able to use these new types of equipment, as I mentioned
8 earlier, and there may be some need for consideration of
9 environmental justice, as well as from an access
10 perspective, as well as from the environmental -- the neat
11 environmental consideration that we often think about when
12 we think about environmental justice.

13 Finally, I think another thing that we need to
14 think about is that there may need to be some flexibility,
15 especially for larger types of equipment, larger loads of
16 equipment, as we kind of commence down this journey. In
17 the near term, smaller equipment types may be more readily
18 available from a heat pump or other perspective in order to
19 move forward at this time.

20 So let me pivot now and talk a little bit about
21 the standard that AHRI has been working on. So AHRI, as I
22 mentioned earlier, works with the stakeholders to develop
23 consensus standards, and one of the standards that we're
24 working on currently is AHRI 1430 which is the Anti-Water
25 Heater Standard for Demand Response, so DR for electric

1 resistance storage and heat pump water heaters. The goal
2 is to develop a test operating and physical procedure, as
3 well as required administrative controls, so data and
4 marketing and nameplate requirements and to ensure that
5 this equipment is enabled to communicate in a standardized
6 protocol including, but not limited to, current options.

7 The first draft of this standard has been
8 submitted to the working group for review, and working
9 group participants have been providing comment and are
10 driving toward consensus on the specific content of the
11 standard. I would mention, as well, that the working group
12 participants include NGOs as well as members from
13 regulatory agencies such as DOE, EPA, and others, and they
14 also include AHRI members which manufacture equipment.

15 So, very quickly, hopefully we are helping to
16 catch us up a little bit, but those are just some of the
17 things that I wanted to make mention of. So thank you very
18 much for the time, Gabriel, and I will turn this back over
19 to you.

20 MR. TAYLOR: Thank you so much, Helen.

21 Next up we will shift the discussion to
22 manufacturers of equipment, again focusing on the supply
23 side of the issue. So first up we have Ankur Maheshwari,
24 the Senior Project Manager at Rheem. Ankur?

25 MR. MAHESHWARI: Thank you, Gabriel, and thank

1 you, Commissioner McAllister, for this opportunity. Really
2 appreciate it. I'm Ankur Maheshwari. I manage Rheem's
3 global decarbonization strategy, so I do get an opportunity
4 to work with a global team and look at the space of
5 decarbonization from a global angle.

6 Rheem, as most of you guys know, manufacture both
7 air and water product. On the water side, we manufacture
8 water heaters that are used in water heating application,
9 domestic hot water application, under Rheem, Ruud, and
10 Richmond brand. On boilers we make boilers in commercial
11 application under Raypak and IBC brand. We make pool
12 heaters, as well, under Raypak brand. We make air
13 conditioning under Rheem and Ruud brand for both the
14 residential and commercial applications. We do have HTPT
15 (ph.) that makes refrigeration. So we are a very well-
16 rounded air and water solution, sort of the great partner
17 when it comes to building decarbonization.

18 Rheem, has a global footprint so that also allows
19 us to look at this particular challenge from a global
20 scale. We look at this in Australia where the solar
21 penetration is really heavy and the grid is challenged with
22 too much electricity coming from the on-site generation, so
23 we have demand response -- a product being offered in the
24 Australian market.

25 On the other side, we are looking at our company,

1 Intergas, in Netherlands, where it's a really low cooling
2 market, so all the heating is done with water heaters, and
3 they use gas combi so that market is rapidly moving to an
4 all-electric. So we launched an all-electric combi unit
5 that does both domestic water heating as well as space
6 heating.

7 So I can get us -- bring us back to U.S. Rheem
8 did launch the first heat pump water heater in the U.S. for
9 the U.S. market. Our core philosophy when it comes to
10 designing what any product is really customer empathy. We
11 start with the customer empathy, trying to understand what
12 the customer in the market needs, and that's where we
13 start. All our innovation are driven from market customer
14 side and a plumber, what the plumber is looking for. So
15 our real innovation really starts from what is the need at
16 the market space and what will make the life of our
17 customer as well as our plumbers easy? Whether it's a zero
18 clearance that we launched in our last generation heat pump
19 water heater that made the installation much easier for our
20 plumbers and reduced the installation time, hence, helped
21 the adoption of heat pump water heater; or whether it's
22 easy ducting of a heat pump water heater, again, made the
23 heat pump water heater installation much more flexible.

24 Some of the things that we've done in past, we
25 launched our first -- we were the first one to launch the

1 tier 3 product. We weren't the first ones, sorry. We
2 launched our first tier 3 product in 2017. We were the
3 first one to launch the 15 amp product that was
4 specifically targeted for California market with the
5 challenge of electrical -- you know, great panel capacity
6 issues in California homes.

7 We did launch a first integrated Wi-Fi heat pump
8 water heater in the market, and we were the first one to
9 launch a tier 4 product and also first one to launch a
10 product that complied with JA13 that was a big California
11 initiative.

12 Some of the future things that we're looking
13 forward to. You saw the pictures that some of the plug-in
14 product that we're really looking forward to introducing,
15 the plug-in product that we've heard so much about. We
16 have been field-testing that product in the market. We've
17 heard really nice reviews on -- from the plumbers as well
18 as from the field test participants on the product, and I
19 think it will be a great product and it will help with
20 market transformation in California. We are also
21 launching -- will be launching our commercial platform here
22 shortly.

23 Let me focus a little bit on the subject on hand,
24 a manufacturer perspective. One of the biggest
25 challenge -- I would say I have a few points -- is

1 uncertainty around regulatory roadmap and it really leads
2 to a lower adoption at supply chain. We clearly understand
3 the California climate goals and I think there is clear
4 understanding of that net zero economy by 2045, but there
5 is little understanding of what are the minute steps that
6 needs to be taken to get there. So I think that's -- more
7 clarity around that will be really helpful. I think Panama
8 did mention a little bit around that, so I won't harp too
9 much on it, but I think it will be very helpful for the
10 supply chain to get a little better clarity on that.

11 Market adoption for heat pump water heater is
12 really low, and it continues to -- market is growing, so I
13 don't want anybody to get me wrong, but the adoption as a
14 percentage of total market is still very low. I think
15 there are some low-hanging fruit. And again, we have been
16 talking about that new construction being one of the low-
17 hanging fruit, and it still stays as low-hanging fruit. I
18 think that's something that is -- that's something that we
19 should consider as a driver to push that market adoption.
20 But California market adoption continues to stay low. It
21 really puts the supply chain in a quandary and it forces
22 the supply chain to stop multiple skills which is not --
23 which is challenging, especially in California where floor
24 space is quite -- is at a premium, as you guys are well
25 aware of. I'm in Atlanta. It's not as bad here.

1 Consumer awareness is very challenging. We have
2 done and we continue to do a lot of services. All the
3 manufacturing partners do. And one of the things that
4 we -- consumer awareness around the goals, the climate
5 goals, are not as clear, so I think The Switch Is On, is
6 great, and those type of campaigns needs to continue. I
7 think that pull through will allow the market adoption to
8 take place. We need to really hit the replacement market.

9 Statewide programs will help. There are a lot of
10 incentives out there, but sometimes it is very difficult to
11 get supply chain motivated to take advantage of those
12 incentives. The requirements are too cumbersome and it's
13 quite difficult because sometimes the distribution crosses
14 over multiple territories and it is absolutely difficult.
15 So statewide program will help, so I'm really looking
16 forward to TECH initiative and SGIP, so great work, all the
17 folks that work on SGIP.

18 Grid resilience still continues to be a challenge
19 or a question mark, I would say. So I think a good
20 awareness campaign would be helpful. There is somewhat of
21 a challenge and I think it will, unfortunately, will get
22 worse through the summer, although decarbonization is
23 really for heating because cooling is already on
24 electricity. So I think grid resiliency is something that
25 will be helpful if that's highlighted. When the buildings

1 are decarbonized, how is the grid going to be -- going to
2 support all of that decarbonization?

3 So that's my -- at least that's my perspective.
4 And I, again, appreciate the time and the opportunity. And
5 thank you, Commissioner McAllister, for this.

6 MR. TAYLOR: Thank you very much, Ankur.

7 Next, we have Josh Greene, another manufacturer.
8 Josh is the Vice President of Government and Industry
9 Affairs at A.O. Smith. Josh?

10 MR. GREENE: Thank you, Gabe. And thank you,
11 Commissioner McAllister, fellow Commissioners, for allowing
12 us the opportunity to participate at this morning's
13 workshop. The presentations by my peers and colleagues
14 have been wonderful and we'll try to keep up with that high
15 bar and be as efficient as possible.

16 So as I think we get into presentation mode, you
17 can see there I am Josh Greene, Vice President of
18 Government and Industry Affairs for the A.O. Smith
19 Corporation.

20 You can go to the next slide. This is just the
21 overview of the presentation we're going to walk through.

22 Next slide. All right, at A.O. Smith, you know,
23 we have our vision. Not going to read every word on the
24 slide, but we're really about creating long-term value for
25 stakeholders in a socially responsible manner and drive

1 profitable growth. A.O. Smith is publicly traded. We're
2 an S&P 500 company, the only one in our space, in our
3 industry. So we take that leadership role very seriously,
4 as well as our vision.

5 Next slide. So when we're talking to our
6 stakeholders and peers and friends, we ground ourselves in
7 our values, and we want to make sure that we're
8 communicating that. The Smith family that started the
9 company in Milwaukee, Wisconsin, in 1874, handed down a
10 series of values by which we do our work and live our work
11 lives. And consistent with that, A.O. Smith will always be
12 a good citizen, and part of citizenship is making sure that
13 we are participating in forums like this, being a resource
14 to regulators, our industry, our peers, and other
15 policymakers.

16 Next slide. There you go, thanks. So we're here
17 to talk about equipment, what's available, and some of the
18 other issues that manufacturers in our space are looking
19 at. So at A.O. Smith, as far as heat pump technology is
20 concerned and our water heaters line of products and skus,
21 we have products that are readily available for all of
22 these different applications. Now, as you've heard and you
23 will hear into the future, for commercial and multifamily
24 and some commercial systems, we still have a little bit
25 more ways to go, and we'll talk about that a little later

1 on in the presentation.

2 Next slide. So I'm just going to walk through
3 some of our offerings here. Not going to take a lot of
4 time on these slides. I'm going to let you read them and
5 of course stakeholders can get the presentation on the
6 docket. But, you know, our most ubiquitous product for
7 standard residential is our 240 volt product that is
8 readily available today. We sell across the United States
9 and including in California with very high efficiencies.

10 Next slide. So as my colleagues have also
11 referenced, in California we have our JA13 certified
12 residential product, the 240 volt. We are excited about
13 that. We're working with our contractor network as well as
14 some builders, amongst others, to get continued feedback on
15 the product. Obviously, it has demand-response
16 capabilities, and we're looking to see how many of these
17 products make their way into the install base.

18 Next slide. So our standard residential product
19 we've been selling for many years. As those of you
20 probably participating on this workshop know the A.O. Smith
21 brand. And again, this is a national product that we sell
22 in many markets including California.

23 Next slide. I think we can go to the next one.
24 So unitary commercial, we were a manufacturer that brought
25 the first kind of product like this to the market. Very

1 happy with it. We have some of these products in the
2 install base now, restaurants amongst other installations.
3 But again, it's still a nascent type of technology, a
4 nascent adoption. We are looking to have, you know,
5 nationwide adoption of this particular product. But again,
6 it has its niche, and that's one of the things that we have
7 to remember moving forward that different types of
8 technologies are appropriate for different applications and
9 installations.

10 Next slide. So moving on, our commercial split
11 systems. Again, another nascent product. These are being
12 used across the country. We can see a lot of these in
13 Pacific Northwest and growing in California. But this is a
14 type of technology that, again, we would remind certainly
15 our friends at the Commission, amongst other stakeholders
16 that we've discussed this particular sku with across the
17 country, that flexibility in terms of installations is
18 really going to be needed. Right? Because these are
19 systems that go into multifamily applications, they could
20 go into larger nonresidential installations, but all of
21 those are going to be specific, specifying engineers,
22 working with architects, and there may need to be the use
23 of, you know, dual fuel backup depending upon where you are
24 in the country.

25 Next slide. So we do certainly have 120 volt

1 plug-in product on the way. We're excited about this.
2 We're going to have to see what the market adoption is, but
3 certainly as we think about -- and as Panama and others
4 have referenced in the retrofit market -- where the install
5 base is, you know, that's really the challenge as it
6 relates to the transition of building decarbonization. Got
7 to have the products that meet not only the needs of
8 customers and provide value but also, quite honestly and
9 candidly, can be installed and done so at price points and
10 cost points that make sense for all parties.

11 Next slide. And coming soon, the plug-in heat
12 pump water heater with NEEA 7.0 spec. We're, again,
13 excited about this. We'll see. We've gotten some initial
14 really positive reaction. But again, nascent product.
15 It's going to take some time for the market to adjust but,
16 nevertheless, we're excited about the future.

17 Next slide. So a little bit more of the meat of
18 the presentation. Supply chain. So as all manufacturers,
19 regardless of the particular widget that we manufacture,
20 but in the context of our conversation today I wanted to
21 take, you know, about a minute or two on this particular
22 slide. I know we're all dealing as manufacturers with a
23 snapshot in time. Not the typical market conditions coming
24 out of the global pandemic but, nevertheless, supply chains
25 are stressed. Steel is the largest commodity purchased,

1 certainly, by many manufacturers. We have discussed this,
2 certainly, in our investor calls and other public forums.
3 As I said earlier, we are publicly traded. But wanted to
4 give some context. You know, you see the chart we have
5 included in our presentation. The published steel price is
6 in Platts. That's the spot market. Now, we're a global
7 manufacturer and we're sophisticated enough to have hedging
8 strategies amongst other things to mitigate risk. But when
9 you see this kind of spike in terms of the short ton of
10 steel that needs to be used in products, that's pretty big.
11 Again, supply chain will continue to ramp up and capacity
12 will continue to ramp up, but when manufacturers have to
13 pay almost \$2,000 on the spot market for steel, that will
14 have downstream pricing impacts.

15 Similarly, as the transition to more heat pumps
16 both for space heating and water heating -- and again,
17 regardless of installation or application -- begins to ramp
18 up, there will be supply chain pressure, right, on
19 compressors, components, electronics, amongst other things.

20 The other -- and Helen made reference to this --
21 are refrigerants, and that's a big piece of the pricing
22 puzzle with heat pump technology. And certainly we are, at
23 A.O. Smith, supportive of transitioning our carbon
24 footprint, not only as a company but also in our products.
25 But refrigerants are a key piece of heat pump technology.

1 Right? A Captain Obvious statement. But as California,
2 let alone the federal government, other governments around
3 the world, transition to lower GWP-value refrigerants, that
4 takes time for manufacturers to work into their supply
5 chains, and it will come at a cost. So we have to keep
6 those things in mind as we continue kind of a pragmatic
7 transition as it relates to building decarbonization.

8 Finally, on manufacturing capacity, from our
9 perspective, we do think that current demand for heat pumps
10 are satisfied. Additional capacity certainly is available
11 and probably some additional capital investments will need
12 to be made. But again, just to reemphasize, broader heat
13 pump adoption will place strain, right, on global supply
14 chains, and we have to remember that.

15 And then, finally, we've heard this to be an
16 aspirational goal, and that's great. We always need goals
17 to keep us going. You know, the 1 million heat pump water
18 heaters in the install base in California over the next
19 five years, probably not going to get there. But, you
20 know, arguably maybe in another 10 or 15 years. But again,
21 just putting that all in context, strains on the supply
22 chain have to be thought about.

23 Next slide. So just market projections. Right?
24 This is 2019, so I know we have another year of data that
25 we could probably have shown. But just for context about

1 Energy Star units, of which heat pump water heaters
2 automatically qualify, we wanted to really lay out here
3 tankless, gas tank, heat pump water heaters that are Energy
4 Star certified. This is across the country, obviously.
5 It's not California-specific. But you can see kind of on
6 the gas side what we as manufacturers have to manage,
7 right, when it relates to our high-efficiency equipment,
8 both gas and electric. So you can see the somewhat nascent
9 adoption where we still are. We want to work with
10 stakeholders, the Commission, and others on ways in which
11 we can increase market adoption, certainly of Energy Star
12 covered units.

13 Next slide. So just a minute on this slide.
14 Market projections. So we did our best here using feedback
15 not only from our customers but other data sources. And I
16 know it's a lot going on, on this slide, and I apologize
17 for a whole bunch of the numbers, but you'll be able to
18 maybe do some number crunching. But this is just our best
19 estimate of market projections and trends specifically
20 correlated with the current Title 24, right, 2019 code,
21 where we may be heading in 2022 and beyond. And again,
22 from a manufacturer's standpoint, we need to address what
23 our customers are asking for, what they're spec'ing in, and
24 we work with them on these particular issues, but in the
25 very short term we still see gas tankless as being the

1 preferred option of builders in California. Now, the new
2 Title 24 code may change some of that in terms of the
3 incentives, amongst other things, but our projections right
4 now is that heat pumps will increase, right, but they still
5 will be a -- delta, rather, will still be there by and
6 between condensing gas tankless and heat pumps. And then
7 as we move forward, kind of 2024, 2025, the numbers start
8 to increase, right, because you'll have the code adoption,
9 but you'll also have a lot of incentives that my peers
10 before me presented on. And you see that little asterisk
11 there on the TECH, BUILD, and SGIP incentives.

12 Next slide. So future state: new construction
13 programs; instant rebate programs, really a way to move the
14 market; we've got to keep up the incentives for the
15 retrofit and replacement market; advertising; contractor
16 training. And, finally, business certainty on regulations.
17 Right? The natural gas bans are just very hard to
18 navigate. Now, as manufacturers of water heating
19 equipment, we're also dealing with air districts that have
20 their own policy goals and objectives that may overlay,
21 right, with building decarbonization.

22 Next slide. And I think that should be it. That
23 should be it. Yes, it is. Thank you for your time this
24 morning.

25 MR. TAYLOR: Thank you so much, Josh. That was

1 an excellent snapshot. I'm looking forward to getting that
2 data, that information in the record so that we can
3 reference it.

4 And, in final, our anchor for this panel is Amy
5 Egerter, Manager of Carbon-Free Buildings at the Rocky
6 Mountain Institute or RMI.

7 MS. EGERTER: All right, thank you. Can you all
8 hear me? Great. Okay, excellent.

9 So, yeah, I'm Amy Egerter. I'm Project Manager
10 for the REALIZE California Initiative here at RMI. And
11 just a quick overview on kind of our scope and goals for
12 REALIZE California. And we're focused on achieving zero
13 carbon in multifamily buildings in California starting with
14 the affordable housing sector in disadvantaged communities.
15 And we are funded by three California Energy Commission
16 EPIC grants that end around 2024.

17 So REALIZE California, our overall mission is to
18 accelerate building decarbonization by developing
19 affordable and streamlined solutions that make buildings
20 healthier for the people and the planet. And we'll get
21 more into what exactly that entails later in the
22 presentation, but our overall theory of change is to first
23 standardize the way that we design and implement retrofit
24 packages, so we're focused a lot on prefabrication and
25 industrialized construction and looking at the value add

1 that that can provide in deploying retrofits. The second
2 is to streamline financing which I won't talk about very
3 much today. And then the third is the hope that those two
4 things combined, in addition to working with building
5 owners, we can scale these solutions quickly and see some
6 cost reductions and an increase in the retrofit rate.

7 So we can go to the next slide. REALIZE
8 California is inspired by a Dutch program called
9 Energiesprong. Some of you may have heard of it. But the
10 technologies that we're focusing on transferring originated
11 in the Netherlands, and we're trying to see how they fit
12 into the California market here through our grant work. So
13 the three technologies -- or mainly two technologies that
14 we're looking at are the prefabricated wall panel -- the
15 prefabricated roof, I think, fits into this category a
16 little bit. But the wall panel would include high-
17 performance windows and doors in it, and you kind of over-
18 clad the building from the outside and get really high
19 levels of air-tightness and insulation.

20 And then the second is this integrated all-
21 electric mechanical pod that includes domestic hot water
22 heating, cooling, ventilation, and controls. So these
23 retrofits are all electric, and so we're hoping that these
24 quicker deployment and standardized deployment of all-in-
25 one systems will help make the retrofit process a little

1 bit easier and less disruptive.

2 And take it to the next slide. So to start out,
3 in order to standardize a retrofit, we had to understand
4 which buildings would be most conducive to scale in
5 California, and we are focused on multifamily housing, and
6 so we did an extensive typology study of multifamily
7 buildings in California in partnership with the Association
8 for Energy Affordability, and these were kind of our
9 results where these are kind of the most frequently
10 occurring multifamily buildings that we think if we design
11 our standardized solutions for these building typologies
12 that would be most conducive to kind of scale, which is the
13 ultimate goal here.

14 So the three building types are, one, this
15 townhouse type of building that looks very much like a
16 single-family building but just has four to six units in
17 it. The second would be a garden style apartment building,
18 you know, thinking two to three stories, walk up, exterior
19 circulation, maybe a little bit smaller. And then the
20 loaded corridor building here on the right which would be
21 the largest type of multifamily building, about two to
22 three stories, and has interior circulation. We did see
23 that the vast majority of multifamily buildings in
24 California were three stories or less, so that is what
25 we're targeting at this point for our product development.

1 And we can go to the next slide and get into,
2 yeah, some of the differences. This is not a shocking
3 statement here, the title of the slide, but low-rise
4 buildings in California are not the same as Dutch low-rise
5 buildings. But I think that there are some pretty
6 important differences in the aspects of how they're
7 different that have an impact on how you could deploy a
8 prefabricated wall panel or an all-in-one mechanical pod.
9 The first of which, which has a big impact on the wall
10 panel, is that buildings in California are wood framed and
11 not brick and masonry as they are in the Netherlands, which
12 means that the buildings are much more lightweight. They
13 have a much lower structural capacity for additional weight
14 that they can put on the building.

15 And in addition to that, we are in a seismic zone
16 which means we have to be a little bit more concerned with
17 lateral loads and how the building would move with extra
18 weight on it during a seismic event.

19 And then the second on the mechanical side is
20 that in California we do have heating and cooling loads. I
21 think someone mentioned it earlier in their presentation
22 that in the Netherlands they mostly only heat, and it's,
23 again, mostly with radiant heat; whereas, we're heating and
24 cooling with air here in the United States. So those two
25 aspects have some impacts on how we deploy those

1 prefabricated technologies in California.

2 So next slide. We have one grant that
3 specifically is focusing on developing the prefabricated
4 exterior retrofit panels, and our research has shown that
5 existing stick-frame buildings in California can only carry
6 about a maximum of 5 pounds per square foot on them. So we
7 are working with a national building component manufacturer
8 called Dryvit and they have facilities -- they serve the
9 entire United States. They brought many envelope products
10 to market already. We're working with them on kind of how
11 we can use some of their existing and new products to
12 develop this retrofit panel. One of our retrofit panels
13 will be between 2 to 4 pounds per square foot. It will be
14 nonstructural. And because of that, because of this weight
15 limit, the windows and doors can't be integrated. But we
16 are doing some R&D on how we could include some structure
17 in the panel and potentially include the windows and see
18 how that changes the on-site labor and deployment time.
19 And that's just in comparison to what's going on in the
20 Netherlands is they have these large structural panels that
21 are 8 to 12 pounds per square foot. And it's basically you
22 can use that panel for a new building or a retrofit
23 application.

24 Take it to the next slide. This just shows the
25 retrofit process of how you would deploy the exterior

1 retrofit panel. I guess the biggest thing to note is that
2 this process does rely heavily on 3D scanning and
3 understanding the existing building conditions. So that is
4 also a product that Dryvit is working on integrating into
5 their delivery model.

6 Next slide. On the HVAC side we were able to
7 find an all-in-one mechanical pod that heats and cools with
8 air. It's currently being manufactured in Germany by a
9 Swedish company, and we're working very closely with their
10 German product development team to import this product into
11 the United States, get it UL listed. We're also going to
12 swap out the refrigerant for a low global warming potential
13 refrigerant, R32, and deploy that on one of our
14 demonstration sites. And this manufacturer we're
15 particularly excited about partnering with them because
16 they do have existing U.S. manufacturing facilities which
17 will be great. Once it's UL listed and there's more demand
18 for this product, they can shift some manufacturing over to
19 the U.S. and make this kind of a U.S.-made product. But
20 just this graphic, this rendering, shows how the pod is
21 installed outside, and then we're using prefabricated
22 ductwork to connect the pod to the existing ductwork
23 distribution in the building.

24 Next slide. This is just a nice rendering
25 showing you how it looks. You can't see the pod, it's on

1 the other side of the building in this image, but new look
2 and feel, basically.

3 Next slide. Just quickly about how we are
4 planning to aggregate demand in scale solutions for the R&D
5 work in the products that we're developing. REALIZE
6 California, we'll be partnering with the Department of
7 Energy's Advanced Building Construction Collaborative, the
8 ABC Collaborative, to kind of dynamically work together
9 aggregating demand at the state level and also the national
10 level. The products that we're working with are not just
11 applicable in California. I think, you know, there are
12 low-rise stick-frame buildings across the U.S. and, you
13 know, the mechanical pod could work in new construction or
14 retrofits across the country. So I think the main things
15 that we're doing is we're developing guidelines by
16 typologies across the United States and in California to
17 come up with retrofit guidelines and specifications that
18 can then get passed on to the manufacturers. The ABC
19 Collaborative is working with a much larger group of
20 manufacturers and we will match those. At the same time,
21 we're also working with building owners to get them to
22 commit a certain number of buildings in their portfolio on
23 an annual basis to say we will adopt these technologies if
24 they meet criteria A, B, C, you know, they're cost
25 effective, they will enable zero-carbon buildings, et

1 cetera. And then we would match these manufacturing
2 partners with the building owner demand that we're hoping
3 to aggregate over five to ten years to give those
4 manufacturers confidence that there will be someone to buy
5 their product once they kind of take that leap of faith and
6 do the R&D. So we'll connect them, and then REALIZE
7 California and the ABC Collaborative will kind of monitor
8 and address R&D gaps in an ongoing basis.

9 And next slide. This is the last slide. Just
10 some thoughts I'd throw in here for consideration for
11 future policies. When working with state and federal
12 dollars for funding to promote R&D of new products, I think
13 that we run into some issues of intellectual property and
14 how royalties are handled on an ongoing basis. So if
15 additional public dollars are going to be given to fund
16 commercial innovation, those conversations should be had
17 about how that works on an ongoing basis to promote
18 commercialization.

19 And then, yeah, I think especially working in the
20 affordable housing sector, utility bill affordability and
21 just a whole host of other issues like deferred maintenance
22 that face building owners are really making us see that
23 holistic solutions as opposed to just one-for-one swap outs
24 in this sector are really needed.

25 And then final note is Low-Income Weatherization

1 Program already got a shout-out on this call. I just want
2 to give it another plus one and say that it's been a really
3 successful program for many of the building owners we
4 talked to. They really like it and would want it to be
5 expanded.

6 So next slide. Just also I want to end on a huge
7 thank you to our partners. It wouldn't be possible without
8 them. And thank you for the Commission, thank you to the
9 Commissioners for listening and, yeah, really excited for
10 the conversation. Thank you.

11 MR. TAYLOR: Thank you very much, Amy. Really
12 appreciate you taking the time to come speak with us today.

13 So now we'll turn the cameras back on, please,
14 for the panelists, and we'll have an opportunity to
15 interact with the Commissioner. Commissioner McAllister?

16 COMMISSIONER McALLISTER: Thanks, Gabriel. Nice
17 job moderating. And thank you so much to all of our
18 speakers. That was a really nice -- you all complemented
19 each other very well and lots of substance there. I
20 actually -- I guess I'll just ask a couple of -- at least
21 one high-level question just to hear your thoughts about
22 essentially how we get to -- your thoughts about what is
23 needed to really get to scale. For example, Amy, you
24 talked about bringing some of these technologies, testing
25 out -- doing some pilots on the Energiesprong model. You

1 know, what's the timing to sort of show success, retool as
2 lessons dictate, and then move on and try to get some
3 scale? And sort of similar need from your particular
4 perspectives, you know, the OEMs and HRI, you know, the
5 market representatives; what are sort of your top three
6 policies that you could -- that you feel like you need to
7 have clarity? And you sort of mentioned some of them, but
8 I wanted to just sort of not delve into too many details
9 which is always tempting here but really -- you know, we
10 have a huge state with 40 million people in it and, you
11 know, 12-plus million existing buildings and residences and
12 not that much time. You know, 20 years from now we will be
13 at the time we need to be basically hitting the goals. And
14 that's only one or so product cycles in any given house or
15 building -- or replacement cycles, rather. So what do you
16 need to sort of really make those investments you talked
17 about and show success and get to scale? And I want to
18 just get your general views on that and then I want to open
19 it up to my colleagues on the dais and then also get some
20 attendee comments, as well, or questions.

21 MS. EGERTER: I can start.

22 COMMISSIONER McALLISTER: Please.

23 MS. EGERTER: Yeah, I think -- I mean, this has
24 been echoed by many other people who have spoken today, but
25 I think really strong policy that lays out a very clear

1 roadmap is the easiest thing for manufacturers to react to
2 and know that they will have committed demand over -- you
3 know, past 2025 or what have you, and they can ramp up
4 their own R&D in relation to that.

5 And then I think also -- I mean, I'm speaking
6 from mainly working in the LIHTC, TCAC funded sector, but I
7 think incentives to fill the gap and address deferred
8 maintenance and all of the whole host of issues that face
9 those building owners. We see especially as LIHTC gets
10 more competitive less access to those dollars, and then the
11 ability to retrofit their buildings kind of goes -- you
12 know, they just don't have the funding to do it. So I
13 think increasing funding sources like LIWP, which is a
14 carbon-based incentive program that comes with heavy
15 technical assistance, is going to be really key in getting
16 those building owners to say yes and improve their
17 buildings. So those would be my top two, but I'm really
18 interested to hear what other people say.

19 COMMISSIONER McALLISTER: Thank you very much.

20 MS. WALTER-TERRINONI: Commissioner, this is
21 Helen Walter-Terrinoni from AHRI. So maybe a couple of
22 different things. I think what we saw in the refrigerant
23 transition is that a really serious view needed to be taken
24 around the barriers that exist, and we needed partnership
25 with other stakeholders, so whether it be regulators and

1 governmental officials as well as other stakeholders in the
2 supply chain and NGOs. And we've kind of come together
3 with a task force, actually, that we host to kind of look
4 at these barriers and try to get them addressed. If we
5 move forward without addressing them, we'll end up in the
6 same boat where we are around building codes with
7 refrigerants where California could be the only state in
8 the country where we can't move forward with low-GWP
9 refrigerants. And so those barriers are real. We need to
10 think through them and handle them.

11 The other thing, on the more sunshiny side of
12 things -- so that's very depressing, right? And it sounds
13 like a lot of work, like we have to roll up our sleeves and
14 really get to work. But on the happier side of things, you
15 know, we have found -- we kind of did an informal study,
16 and we found that there are some incentive structures that
17 actually move the needle pretty quickly in encouraging
18 transitions to these newer equipment types. And so that
19 may be something that, you know, we could have a
20 conversation around is what we've seen be very, very
21 effective in the past.

22 COMMISSIONER McALLISTER: Great, thank you. Any
23 examples you have that you could put on the record, that
24 would be terrific.

25 Ankur, Josh or -- anything you need to add?

1 MR. MAHESHWARI: Commissioner McAllister, I think
2 from the technology point of view, I think technology, in
3 essence, is available. The innovation is really going to
4 come from applications side, training side. I think that's
5 going to drive adoption. The plumbers feeling comfortable
6 about installing the equipment, distribution feeling
7 comfortable about stocking the product. And I think that
8 will all come from more clarity, so as much clarity as we
9 can get from the state on the roadmap, I think that will
10 help us further understand what is needed in the
11 marketplace. And I think that will spur a lot of
12 innovation. As you know, there is a lot of product already
13 available in the market. The product that Amy shared, I've
14 seen that product in person. It's about 15,000 euros in
15 Netherlands. So there is innovation available, and I think
16 it's very good innovation available globally, and it needs
17 to scale up. I think that will be helpful if we have a
18 clear direction available when it will scale up.

19 MR. GREENE: Commissioner McAllister, I would
20 just add the following kind of more blocking and tackling.
21 And that really revolves around two things: cost, value.
22 Cost and value for homeowners, right, cost and value for
23 builders, cost and value for our distribution partners. I
24 agree with Ankur and others; the technology and the
25 available equipment is ready to go. Innovation will

1 continue. A.O. Smith has been innovating for 147 years.
2 We will continue to innovate. The trends, right, for
3 building decarbonization and heat pump technology, we've
4 already made that decision. So really this is about
5 signals to how do we get a consumer whom in our
6 industry -- not so much on space heating but it's
7 applicable.

8 But on the water heating side, as you know better
9 than anyone, 80 percent of our business is a 24-hour
10 emergency replacement. I mean, that's 80 percent of the
11 business. So in that 24 hours, how do we get that consumer
12 to convert over from electric resistant to heat pump or a
13 gas conversion? The most effective tool that we have seen
14 in our national programs is an instant point of sale rebate
15 right there when the consumer needs to make a decision.

16 Now, that's easier probably in certain single-
17 family homes where a panel upgrade may not need to be as
18 robust. But, hey, the 120 volt product that's coming on
19 the market is another way to achieve that goal. So we're
20 trying to keep a clear focus on what's going to drive
21 adoption of the technology, and that will lay the
22 foundation for further market transformation. And probably
23 from a policy perspective -- we talked about it in my
24 presentation, and I know, Commissioner, you and I have
25 talked about this before -- the regulatory signals are very

1 important.

2 What's being done in some other states --
3 California is always the leader, I know, I know -- but
4 what's being done in other states, right, is very similar
5 to what the state of California has done and other states
6 are doing on renewable energy and EERS standards. So if we
7 know that in 20 years or in 10, 15, whatever it is, pick
8 your kind of decade approach, that X number of units or X
9 number of households need to be -- and Panama touched on
10 this a little bit -- need to be heat pump or need to be
11 electric, whatever that may be, that's good. That's a good
12 signal, right, as opposed to what we're seeing now which is
13 bespoke kind of this is getting cut off next April, this is
14 getting cut off next December. That makes it more
15 challenging and more difficult to make capital investment
16 decisions. So I know there was a lot there in my answer,
17 but just wanted to go from the granular, right, to the more
18 macro.

19 COMMISSIONER McALLISTER: I really appreciate
20 your emphasis on the retrofit, the emergency retrofit
21 market because I think that absolutely is a place we could
22 work together. And to the extent we're talking about the
23 capital state, in quotes, whether it's the Energy
24 Commission or something more broad -- PUC, obviously, would
25 be involved -- but I think that actually seems like a nice

1 leverage point. I know many market actors are thinking
2 along these lines but some concerted effort or concerted
3 attention to this from sort of a state branding perspective
4 might actually really move the needle. And maybe in the
5 final 3232 report we can emphasize that kind of a need to
6 really achieve the aggressive scenarios that are going to
7 get us to our building decarb goals. So note to staff on
8 that one. I'm just really talking to the Commission staff
9 with that comment.

10 But anything you can put on the record about
11 experiences that draw parallels with many of these market
12 transformation efforts from your perspectives in the
13 marketplace and as advocates, I think, would be super
14 helpful for us to really focus -- make sure we're focusing
15 on the right things and building the right coalitions to
16 help move this needle. So really appreciating all of you.

17 And looks like Ralph -- sorry I missed you,
18 Ralph. Yeah, go ahead, Ralph. And then after that I'm
19 going to be quiet and we're going to move to public
20 comment.

21 MR. DiNOLA: Yeah, Commissioner McAllister,
22 thanks. As part of the initiative we have a market
23 deployment plan and an immediate task list that we would be
24 welcome to share and put on the record. And as we said,
25 you know, these kind of three priority pathways -- new

1 construction that we really need to get market leaders such
2 as production home builders to adopt, so this would be a
3 market-based solution. But they need the incentives to be
4 there in place for them to make that choice, and then we
5 need the policies to back it up. So that's a starting
6 point. I think several times the Low-Income Weatherization
7 Program was mentioned. That should be an electrification
8 program, there is no doubt, so that the opportunity to
9 address low-income and disadvantaged communities with water
10 heater replacement and space heating replacement and other
11 appliances, as well, certainly cooking appliances for
12 health and well-being of those occupants.

13 And then, you know, the electric resistance,
14 again, probably 6 percent of water heating in California
15 represents a large number of water heaters in California.
16 And if there was a proactive replacement program, a swap-
17 out program, there's no doubt that the water heaters on the
18 market are at least two to four times more efficient than
19 electric resistant, so there's a guaranteed cost savings on
20 operations. It's just that people need to be induced. And
21 short of any kind of fear tactics, we all know that these
22 water heaters fail, you know, Thanksgiving, Christmas, on a
23 Sunday, so what we want to do is a consumer campaign that
24 builds kind of this awareness about this thing that sits in
25 their garage or basement and why it's important to be

1 thinking about it for climate action, for energy
2 efficiency, for basically demonstrating new technology. So
3 the consumer side of the campaign, I think, is also really
4 important.

5 And we probably need to move to, at some point,
6 think about electric resistant water heaters like the
7 incandescent light bulb of the water heating industry.
8 Right? And we know that we're really trying not to sell
9 those anymore. So I think all up and down the supply chain
10 I will reiterate what Panama said which is focus on the
11 upstream early and then work towards the consumer and
12 downstream later. But upstream and midstream, all of the
13 programs that are successful, Maine, Vermont, and in NEEA
14 in the Pacific Northwest, recognized that the midstream and
15 upstream is where you get things to really move. I would
16 say, you know, that point of sale -- for a time Southern
17 California Edison was running a point of sale rebate \$199
18 heat pump water heater, and they couldn't keep them on the
19 shelves. So those are a few suggestions from the Advanced
20 Water Heating Initiative, and we will enter those priority
21 actions into the record.

22 COMMISSIONER McALLISTER: Thanks to you all. I
23 really appreciate that. And lots to chew on. This is all
24 on the record, so we'll comb through and get the nuggets
25 and build on those in both the IEPR and the 3232 final. So

1 this is really -- this is great. So thanks to you all.

2 I did want to now see -- it looks like we don't
3 have a lot of public comment, so we'll just go with the
4 attendee Q&A. So Kristy and Heather, do you want to manage
5 that?

6 MS. RAITT: Yeah. Go ahead, Kristy.

7 MS. CHEW: Hi, this is Kristy. The first
8 question is from Cooper Marcus: Clearly there needs to be
9 dramatic acceleration of heat pump water heaters and heat
10 pump space heating retrofits. I'm not yet seeing any
11 programs that seem likely to produce the big changes
12 needed. I hear lots of "we need to do" but not much of "we
13 are doing" - how do we get to actually do more?

14 COMMISSIONER McALLISTER: We might actually -- to
15 take advantage of our time, maybe we can deem that one
16 answered already with my last question and move on to the
17 next question.

18 MS. CHEW: The next question is from Christine
19 Tam (ph.): To support contractor training, can California
20 require heat pump water heater training as part of the
21 apprenticeship program to qualify for the plumbing
22 licensing?

23 MS. WALTER-TERRINONI: This is Helen. I think
24 that it's important to engage unions and contractors and
25 technician organizations to ask them that question, and

1 certainly the unions here in California and other areas of
2 the country have the capacity to provide excellent
3 training, as well as other training organizations, as well.
4 But I think it's important to engage with them to see the
5 best way forward to encourage qualification and
6 installation. OEMs, equipment manufacturers, also provide
7 training programs, and so certainly that's another
8 alternative for training.

9 But I think this kind of circles back to remove
10 barriers it's important to pull a mixed group of
11 stakeholders together to kind of lay out what they are and
12 kind of work through them one at a time to make sure that
13 they are each addressed. Otherwise, they can hold up
14 important transitions like this. Thank you, Kristy.

15 MR. DiNOLA: Kristy, if I could just say, you
16 know, installers and contractors are basically the sales
17 force for water heaters, especially in the replacement that
18 Josh was talking about. So we really do need the
19 installers to be educated, to have the skills, but also to
20 have the understanding and the sales capability to
21 basically help consumers make this decision and guide them
22 rather than just saying, in kind, we're going to basically
23 do any kind of replacement. Thank you.

24 MS. CHEW: Great, thank you. I think, Heather,
25 that's all that we have.

1 MS. RAITT: All right, thank you, Kristy. Thank
2 you to all the panelists for participating today. Greatly
3 appreciate it. And to Gabriel for moderating that session.
4 So now we're going to move on to public comments. And
5 RoseMary Avalos from the Energy Commission's Public
6 Advisor's Office is going to go ahead and moderate that.
7 Go ahead, RoseMary.

8 MS. AVALOS: Thank you, Heather. I just want to
9 remind folks that if you're using the Zoom platform, go
10 ahead and raise your hand if you'd like to make a comment.
11 And if you're using -- if you're on the phone, please hit
12 star 9 and that will raise your hand. I'd like to remind
13 folks, as well, that it's one person per organization may
14 comment and the comments are limited to three minutes. And
15 I'm taking a look at the list of participants. I don't see
16 any raised hands yet. I'll give it just a few more
17 seconds.

18 I don't see any raised hands, so I'll go ahead
19 and move on with you, Heather, and -- yeah, there are no
20 raised hands right now.

21 MS. RAITT: All right, Commissioner, I think
22 we're ready to just close, then.

23 COMMISSIONER McALLISTER: Okay, well, great. I'm
24 tempted to ask more questions, but I think I'll -- we will
25 have more forums to talk about these issues, lots of

1 ongoing discussion. Really dense topic here, obviously,
2 and a lot of good thinking going into this. I want to just
3 thank all of our speakers for this panel and the first
4 series of talks in the morning. Really appreciate all of
5 you all. And it's great to be talking about solutions.
6 They do exist and we do have means to get them through the
7 marketplace. I would mention a couple of things that I
8 neglected at the opening. We also -- I listed a few
9 workshops that we're going to have on the building
10 decarbonization track. Another one is about refrigerants,
11 which obviously has come up a few times this morning. And
12 we're hoping to sort of co-sponsor that one, at least
13 partner with the ARB on that topic, and obviously there
14 will be a partnership going forward through their scoping
15 plan process. But for our building decarbonization
16 efforts, we certainly want to -- we don't want to neglect
17 the refrigerants. Our analysis is showing that they are
18 both in the building standards and in the 3232 and other
19 forum that refrigerants also have to be a part of the
20 solution if we're going to really proliferate heat pumps
21 throughout the economy. So that's one.

22 And so I want to just make sure that everybody
23 knows we are coming back this afternoon, so please tune in
24 then, as well. And again, I think that is about all we
25 have for the morning.

1 So thanks, Heather. Do you want to just close us
2 down? Oh, maybe you can remind people when comments are
3 due?

4 MS. RAITT: Sure, yeah. And I also -- I
5 neglected to mention that we also have nominations for our
6 Clean Energy Hall of Fame Awards. There's still time but
7 running out to submit nominations for that, and they're due
8 on June 25th, so see our website for more information. And
9 thanks.

10 Can you go to the next slide, Raquel? There is
11 the information for this afternoon. It's going to be a
12 different Zoom login, so if you can do that. And written
13 comments are due on July 7th. And that's all I have.
14 Hoping to see everybody this afternoon.

15 COMMISSIONER McALLISTER: Thanks, everyone.

16 (The morning session was adjourned at 11:45 a.m.)

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MARTHA L. NELSON, CERT**367

August 9, 2021