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STATE OF CALIFORNIA

CALIFORNIA ENERGY COMMISSION

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STAFF WORKSHOP

DEMAND SCENARIOS

WARREN-ALQUIST STATE ENERGY BUILDING

ROSENFELD HEARING ROOM

1516 NINTH STREET

SACRAMENTO, CALIFORNIA 95814

Thursday, April 7, 2022

1:00 P.M.

Reported by:
Elise Hicks

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P R O C E E D I N G S

1:01 P.M.

THURSDAY, April 07, 2022

MS. RAITT: Good afternoon, everybody. Welcome to today's 2020 IEPR Update Staff Workshop on Energy Demand Analysis. I'm Heather Raitt. I'm the program manager for the IEPR and speaking in a mask for the first time is a little awkward. So welcome to our first in-person workshop since the pandemic began. Many of us have gotten used to our remote workshops, and so today we're going to do a little differently. We're going to have a hybrid workshop where we have some of the features that we were using in our remote only workshops, but we're also meeting in person at the old Energy Commission building.

So for those in the room today, videos of the presenters and commissioners on the dais are being broadcast over Zoom and we're using our in-room microphones for the sound. We'll be working on our AV capability here. So but for now, this will work for our videos.

All IEPR workshops are recorded and the recording will be linked to the CEC's website shortly after the workshop. And we're going to

have a written transcript available in about a month. And to follow along the schedule, the slide decks are docketed and posted on the Energy Commission's website. For those in the room, if you'd like to get the materials you can -- there's a QR code posted, you can use your smartphone and it'll scan it and take you to the website page with all the materials.

In the room we also have hard copies of the meeting schedule and we have binders of all the materials at the entrance to the hearing room, if you'd like to review those, and if you need your own copy, just please either let me or Denise Costa know.

We have a few ways to participate in the workshop today. We'll reserve a few minutes after all the presentations on the Demand Scenarios to take a few questions from attendees. We might not have time to address all the questions submitted, and then -- but we will take questions and we'll have another opportunity for questions after staff's presentation on the interagency work. So if you're in the room and you'd like to make a -- take a -- have a question, you can just leave an index card at the

entrance and you can just fill that out and leave it and we will take it at that time.

And for those on the Zoom platform, you can use a Q&A feature to ask a question. And alternatively, attendees can make comments during the public comment period. That will be at the end of the day. Please note that we will not be responding to any questions during the public comment period and comments will be limited to 30 minutes or less. And if you want to make a comment and you're in the room, you can just let RoseMary Avalos know it. That's RoseMary, and she can help arrange that. And when the time comes, if you can just go to the middle microphone at the lectern there and we'll speak in the microphone when you're called on. And then we'll also take public comments from the remote participants and you just press *9 to let us know that you would like to make a comment. Written comments are also welcome and they're due on April 21st.

So just ask for everybody's patience today and bear with us as we might have some bumps as we make this transition in person. And another announcement is that Vice Chair Gunda,

who is leaving us today, needs to leave at 4:30. so if we're still convening at 4:30 Commissioner McAllister has been kind enough to say he would close out the day.

So thank you, and with that, I'll pass it over to the Commissioner Gunda, Vice Chair Gunda. Excuse me?

VICE CHAIR GUNDA: Thank you, Heather. Thank you so much. I just wanted to start off with how nice it is to see everybody in person. It's been -- it's been two years since we went on tele working and it's been a year for me on the commission. I haven't had a chance to see any of the -- any of my colleagues in person. So it's really awesome to see everybody.

So now, as Heather kind of mentioned, we are going to try a few different ways of doing this today and I have to step out at 4:30, so I'm requesting Commissioner McAllister to please close the meeting at the end if I have to jump off. And so at the top, it'll be the first workshop for us for the IEPR update and I want to begin by just thanking the IEPR team. Typically you know, the IEPRs just go from one year to the other and it's absolutely no break for the staff

to really kind of take a break. So you know, to my colleagues in the IPPR team, just thank you so much for all the incredible work you do.

And then kind of going into the EAD staff and the work today that we're going to discuss the Demand Scenarios has been something that we've been thinking through for about two years now. You know, just the power of having a collaborative discussions. t actually started with a conversation with SCE about two years ago. We were visiting in person and then we talked through some of the issues with the rapid goals of electrification and how, you know, if we don't adequately plan for electrification through the policy lens, it will be really hard to plan for some of the builds that we need. So that's really the impetus of the Demand Scenarios.

And then came the SB 100 work. And currently, as you all know, one of the core inputs to SB 100 is thinking through what future scenarios for electricity demand could look like. And so we kind of talked through some of the issues there. And then so between the need for planning both in the mid-term and the long term on electric reliability and then the generation

capacity needed through the policy lens, the Demand Scenarios play an extremely important role and I just want to be thankful and note a few people. Aleecia Gutierrez, the EID deputy who's been at the top leading a number of different efforts, whether it's Demand Scenarios, natural gas transition, SB 100 and reliability. So just Aleecia, thank you to you and the management team for all the incredible work.

Heidi, thank you for your work in just reshaping some of our demand analysis thinking and want to note a few technical staff, especially Mike Jaske, Anitha Rednam, and Ingrid, all of them who have put in a lot of time and effort in thinking through how best to plan this and don't want to leave Quentin, who has been focusing on the transportation element. So thank you all for all the work.

Because this is also an IEPR workshop, just want to lay out a few things for the IEPR 2022 update. We discussed a few changes for IEPR, as a whole to think about how best to socialize this. As you all know, IEPR 2021 we've got some comments from PG&E, I believe, on the length of the document, specifically 500 pages,

but you know, so we really would like to make the IEPR documents shorter moving forward. So the 2022 is a good opportunity for us to think through that, how best to do it. So moving forward, IEPR will be more of a summary document. And then to the extent that we would need to discuss or have a robust record on some elements, we're going to try and do that in what we're doing, what we're calling the OIIPs, the Order Instituting Investigation and Information Proceedings. A couple of them were launched this year, which includes a proceeding on DER and the natural gas transition. So we'll be continuing to do that.

Also want to just make sure we can respond to this.

Some of our sister agencies mentioned that as we move the IEPR into a summary document, it's essential to have a robust public record. So the OIIPs will provide that opportunity for staff to continue to have a lot of staff workshops and build the record necessary for our sister agencies.

This year we have three tracks Energy Transition and equity is a primary track. Second

is called a planning library in which the Demand Scenarios will be a part of. And the third bucket is just thinking through some of the emerging topics like hydrogen, reliability, any other issues that might come up throughout the year.

So with all of that, really looking forward to hearing the presentations from the staff today and beginning this Demand Scenarios work in earnest to think about how best to bookend our planning situation. So with that, thank you. Heather.

COMMISSIONER MCALLISTER: Okay. So I think I'm next. So and then, you know, hopefully the AV and all the -- all that's working well so, seems to be well. So thank you Commissioner Gunda for kicking us off and for leading this year's IEPR. I really appreciate the structural changes as well. I think those are going to sort of play out positively over the long term and result in kind of less silo-ing from year to year of the IEPR activities.

But just really briefly, I think, you know, always excited about talking -- about the forecasting generally, but certainly the Demand

Scenarios and the work we're doing there to kind of expand the suite of approaches and products that overall compose the forecast. And the team that we're going to hear from today has really been working hard on the various elements of this. We and -- just to sort of highlight a point that Vice Chair Gunda just made, you know historically, we've been relatively passive in terms of how we define the scenarios and sort of you know, modeled things as we understood them sort of on the natural sort of organically in terms of the existing kind of marketplace for this or that energy consumption realm.

And then realized, you know sort of over a few years, that we had these aggressive policy goals that weren't really being tracked actively by the modeling. And we didn't have scenarios necessarily that were unpacking those goals and figuring out how we were going to actually meet those goals, what would need to happen to actually meet those goals. And so I think the effort today to really explore this more deeply and come up with possibilities and policy recommendations for having the demand exploration actually drive programs to meet our aggressive

policies really makes a lot of sense. So.

Oh. Oh, sorry.

UNKNOWN SPEAKER: [Indiscernible].

COMMISSIONER MCALLISTER: Okay. Well, I did not count on user error, so apologies for that. Not that everybody -- anybody really wants to see me on camera, but I think that's my obligation. So thank you for letting me know.

So I was really excited about this because it lets us sort of instead of the, you know, the existing sort of universe wagging the tail, you know, being the dog that wags -- that wags us as the tail, we're actually sort of taking control and starting to, you know, be more proactive in terms of how we can -- how our analysis can support actively achieving our policy goals. And so that's a very exciting development, but it takes a lot of work and we've got a great analytical team we're going to hear from today to get us started. So with that, I'm excited to kick things off. So pass the mic to Commissioner Monahan.

COMMISSIONER MONAHAN: Well, thank you. It is so nice to see you guys. So I'm just a little -- usually I'm not at a loss for words,

but it is strange to be with people again and warms my heart to see you guys. So just thanks for making all this extra effort. Thanks especially to Heather. I'm -- my heart goes out to Heather about how hard it has been to make sure that we're following our open meeting rules. We're using Zoom. We're making sure that we are making it easy for the public to listen in. And I think from the number of people on the Zoom platform, we can see that there is very much an appetite for continuing to use Zoom even as we move more to an in-person environment. And I think it behooves all of us to really continually think through how to make sure that we are accessible to the public and especially I think to communities, that it would be really hard to come to Sacramento.

So I think, you know, Zoom has taught us all these good things that can happen in terms of public engagement. So I look forward to being able to have both of those experiences. But that takes a toll on our IT team, and Heather, and others who are making these meetings happen.

So I want to build on something Commissioner McAllister said about how our

modeling is evolving. And I have been having such a fun time working first with Heidi and now with Quentin on kind of reimagining what our modeling looks like in the world of transportation. And you know, there is -- we have these ambitious policy goals that are one of the things that we need to model, but we also need to model sort of where the market may go on its own. And that to me also is something for the future for us to think more deeply about is really, okay the regulatory programs actually set a baseline, but as the price of clean energy technologies falls, like, as the price of batteries for vehicles falls and batteries actually become cheaper than internal combustion engines, what's the role of infrastructure?

You know that's our bread and butter at the Energy Commission is building out zero emission vehicle infrastructure. We really don't know. We can't quantify what's the impact of this charger in this place. And, you know, and maybe we never will be able to do that.

But this idea that we're constantly trying to think through better how to plan for this clean energy future, that if we set the

right policies, may happen largely on its own. And that's super exciting. So I know a lot of people are like, ooh, modeling, ooh, IEPR workshops, that's not very exciting, but I think it is. So just looking forward to this conversation.

And I'll turn it over to Heather.

MS. RAITT: Okay. So dropped my phone. Good. Okay. Thank you so much, Commissioner. So we'll go ahead and get started with staff presentations. And first we have Anitha Rednam and -- oh. What's that?

MS. RAITT: Oh right. And Mike. I was going to say, Mike Jaske. So Mike is going to go ahead first. And so, Mike, just a reminder, just say next slide and we'll advance your slides for you. Thank you.

MR. JASKE: First slide, please. So while the slides -- while the slide comes up, for the record, my name is Mike Jaske with the Energy Assessment Division. As you can see from the scheduled agenda, there's a series of presentations concerning our Demand Scenarios project. Anitha and I will provide an overview

of our goals and approach. Then Ingrid Neumann will present material related to buildings, both efficiency and fuel substitution, mostly adapted from our 2021 IEPR Demand Forecast for this project. Then Quentin Gee will provide an overview of the transportation elements of this effort. And then Gabe Mantegna of Energy and Environmental Economics, or E3, will provide results for total energy and GHG implications. And then once we're finished with the CEC project and after a short break, I will present a brief overview of the Inter-Agency High Electrification Assessment Scenario that the CEC staff have developed in conjunction with the PUC and ISO. Slide 2. No, not next slide. Slide two. There. Why develop this capability? Thank you. Why develop this capability? Thank you.

Our Assessments Division and its various predecessor organizations within the CEC have periodically undertaken projects that use a scenario approach rather than a forecasting approach. A lot of these projects have employed consultants to do the heavy lifting, and although the results are interesting and sometimes been used directly, they don't always result in

capabilities being developed within the staff itself. We had a relatively recent example of this in the SB 100 Assessment that Vice Chair Gunda mentioned, where E3 provided Demand Scenarios that had been developed in an earlier project. And so we really were not fully conversant with all the details of those scenarios and certainly hadn't the capability to generate comparable ones ourselves.

So the bullets on this slide sort of give you a variety of ideas about how and why we want to develop such a capability. Vice Chair Gunda mentioned that we want to directly use this in SB 100, and we also want to tune this capability and its outputs to the needs of our sister energy agencies. Slide 3.

I've already briefly mentioned the first point, but that will come up more as I discuss our inter-agency project toward the end of this workshop. But what we're trying to do within the scope of this overall project is be able to develop demand scenario specifications that address topics of interest, evaluate them both in terms of the final demand end users consume energy, and then at least in some instances,

assess the supply side consequences of these changes in demand. This will help us to develop key insights and to some extent, if we are coordinating appropriately, the results of this may also feed into the desires and needs of our sister energy agencies. We are not at this point proposing to have Demand Scenarios adopted, but that may well become an element of this capability similar to demand forecasts. Next slide, please.

So what are we aspiring to here? We're not there yet, fully for sure. But building off of what Commissioner McAllister said in his opening comments, we are explicitly trying to understand how programs influence end users to change energy usage patterns, fuel choice, etc. When the existing programs don't lead us to our goals, then we want to be able to identify how new programs might replace or augment existing ones. This is hard to do and we, to do it right, we're going to have to tackle many facets of consumer behavior that we have kind of relied upon historic patterns, but as we confront whole new challenges, we need to better understand basic consumer behavior. And perhaps that will

lead to the sort of outcome that Commissioner Monahan just mentioned of the market handling much of this transition itself. But maybe not. Hard to know at this point.

Ms. Rednam will get into the framework that we developed for the initial Demand Scenarios that we're setting out to quantify and Dr. Neumann and Dr. Gee will get a little deeper into the specific programs that we're trying to model in this initial round of assessment. Slide 5, please.

So we set out to accomplish these things that are shown above in the 2021 IEPR, development and assess the scenario, stressing high electrification. Do that by creating or adapting modeling capabilities. Build off the tools that we have now. We were not able to accomplish that partly because of staffing issues that surfaced in the last half of 2021 and there was a priority decision that the demand forecast was a higher priority to complete on time and.

Secondly, sort of in parallel to that last half of 2021, the PUC's desires to better understand sort of the intermediate term consequences of high electrification led to,

essentially a parallel demand scenario project. It slowed down our original plans because rather than merely building capability without a clear user for the product, we suddenly had an inter-agency consensus that a certain form of high electrification infrastructure assessment was appropriate to do and necessary to do on a time scale that sort of caused us to divert a bit from our original plan. And I will get into the details of that as the last element of this workshop.

Please go ahead two slides to slide 7, called Adapting Plans. So as we were developing the original capability and developing our initial demand scenario specifications and gearing up our tools to quantify those this inter-agency team, or inter-agency desire sort of surfaced. And it took some months to sort of sort through what was actually a feasible thing to accomplish, not only in the Energy Commission's domain, but also in the related aspects of a project that involved PUC staff and ISO's staff. And eventually that resulted in this inter-agency High Electrification Demand Scenario project. And so today's workshop is

mostly focusing on the original Energy Commission project, but I will give a status report of the inter-agency effort where it is right now. Go back to slide 6, please.

So I mentioned GHG emissions that were part of the scope of our capability development. And since CARB's just held a workshop to unveil the preliminary results of their 2022 scoping plan projections, I wanted to show how what the CEC is doing and what CARB is doing are different.

The box on the left is a series of bullets, certainly at an overview level of what CARB is doing. While the box on the right is an overview of the Energy Commission staff effort. If you look at these bullets, and I'm not going to go through all of them one by one, but essentially you can observe three things: CARB covers all the GHG emissions sources, while the Energy Commission is only paying attention to those associated with energy consumption. So all the non-anthropogenic sources are not in the scope of our effort and I don't foresee them being for some time, if ever.

CARB scenarios using the PATHWAYS model

are essentially assessments of what-if assumptions. Well, as I said in an earlier slide, we are trying our best to model the impacts on consumption of existing and emerging programs. Programs have -- can be mandates, standards, incentives, education, a whole suite of different mechanisms to induce and even control consumer decision making. But that's not an element of what PATHWAYS does.

And finally, PATHWAYS, at least as it's conventionally used and used by CARB in this scoping cycle, is not run at a level that's detailed enough to allow the kind of electricity and natural gas resource planning that's necessary and to assure reliability. So this is not a duplication of CARB's effort. It's parallel to some degree but getting into much more detail in the selective areas of electricity and natural gas. I believe that is the end of what I have to say, and Ms. Rednam can now take over.

MS. REDNAM: Thank you, Mike. Good afternoon, Commissioners and stakeholders. So my first slide here gives a quick overview of our Demand Scenarios project. The Demand Scenarios

can help examine fuel shifts on the demand side. The consequences of these shifts on the supply side, they help evaluate cross-cutting matrices such as greenhouse gas emissions and costs. So we have developed three Demand Scenarios which extend out to 2050 included varieties of fuel types in our analysis, and we cover a greater range of uncertainties. So these uncertainties could be economic and demographic variables outside our typical forecast range, technology cost, adoption and behavior, and aspirational goals not yet translated to policies. So we use the mid demand forecast as a starting point and adjusted it with load modifier projection tools such as additional achievable energy efficiency, AAEE, and Additional Achievable Fuel Substitution, AAFS, especially for the residential and commercial sectors. Next slide, please.

So in our Demand Scenarios project, like Mike said, we quantify the impact of various existing and emerging energy programs, standards and policies to assess both the energy demand and greenhouse gas consequences. In future updates, we plan to develop demand scenario assessments,

which will provide a sense of how easy or difficult it may be to achieve California's goals and provide necessary insights into where programs need to be developed. So we also aspire to develop our Demand Scenarios capability in such a way such as both the PUC and the ISO can use them in their infrastructure planning process. Next slide, please.

So our Demand Scenarios focus on high electrification. So in our project we have developed different demand projections which by modifying the baseline demand forecast with combinations of AAEE and AAFS. I will go over the framework process a little later in my presentation. So in -- and also in addition to producing demand projections, our Demand Scenario Process also produces greenhouse gas emissions by sector. Next slide, please.

So we have developed and quantified impacts of three types of scenarios for this project: a Reference Scenario, a Policy/Compliance Scenario, and a Mitigation Scenario. So Reference Scenario uses the same assumptions as the CEC adopted managed Mid-Mid demand forecast through 2035. So after 2035,

this scenario assumes the same set of standards, programs, and policies will continue with the same degree of compliance. So this serves as a reference against which Policy/Compliance Scenario and Mitigation Scenario are assessed, and the comparison tells us how much more needs to be accomplished after the processes have been exhausted.

Then the second scenario is built off the first scenario. So the policy elements of this scenario capture the impacts of policies that are not fully included in the Reference Scenario. The compliance elements of this scenario will quantify standards, programs, and incentives that are included in the Reference Scenario, but these are brought to a higher level of compliance than what we've seen in the Reference Scenario. And the increment between the Reference Scenario and the Policy Scenario is the impact of fully achieving the intended goal of the policy or program.

So moving on to the Mitigation Scenario. So this includes additional programs and policies and what-if assumptions. Those are added on to those that are already included in the

Policy/Compliance Scenario. So this is not goal constrained like other scenarios to meet the California greenhouse gas emission reductions target. So the gap between the Policy/Compliance Scenario and the Mitigation Scenario, this tells us the need for further policy development, new program designs, or additional approaches that have not yet been quantified. Next slide, please.

So this slide shows a high level modeling framework. The first column, as you can see, shows the various sectors, then followed by the inputs we have developed for each sector and the fuels we considered. So for the sectors fuels we assessed here in house, in CEC, we can see them in light green and peach color, which are electricity and natural gas for the residential and commercial sectors and for all the fuels diesel, electric, ethanol, hydrogen, etcetera. in the transportation sector. So what we did was we extended our existing demand analysis tools out to 2050, which included our stationary demand forecasting models, our AAEE, AAFS programmatic tools, our Fuel Substitution Scenario Analysis Tools and transportation models.

So for these sectors, as I was telling about in green and peach, E3 inserted our CEC energy demand and load modifier inputs into their adapted PATHWAYS model. Then for the other demand side sectors like industry, agriculture, oil and gas, etcetera, we relied on E3's PATHWAYS model. So then the complete PATHWAYS Scenario is generated, which covers all the sectors and all the fuels that can be seen here. And the results have greenhouse gas emission projections for all these sectors fuel combinations as well. Next slide, please.

So this is -- Commissioners, you must have seen the slide in the -- in our December presentation. That was our preliminary scenario design. So the final -- this scenario design is final here. So the details of the framework will be covered in subsequent presentations by Ingrid Neumann for the buildings components. Quentin Gee will cover the transportation components and Gabe Mantegna -- of E3 will provide the results for total energy and greenhouse gas emissions.

So what we did here are we extended our residential and commercial baseline forecast, which we prepared for the 2021 IEPR to 2050. So

the models are provided with additional years of econ demo data, which is available to us through the Department of Finance and Moody's Analytics. So we generated a Demand Scenario baseline forecast. Then we adjusted the baseline for impacts of AAEE and AAFS, reflecting a business as usual perspective. So this is -- this is best reflected by AAEE Scenario 3, which has long been the standard choice for a managed demand forecast used by both the PUC and the ISO for generation and transmission system planning and procurement.

So for the residential and commercial sectors, AAEE comes entirely from programmatic contributions developed in our energy efficiency and fuel substitution tool. So there are several elements that we draw from for AAEE, which are IOU and POU potential and goals projection. Then codes and standards, savings projections, and beyond utility impacts workbooks. Then for the 2021 IEPR, we have also added fuel substitution as a load modifier AAFS and we treated -- and we added to the baseline demand forecast and treated in a similar way to how we treat AAEE currently.

There are however, two components to AAFS, as we can see on the slide here. The first

being the programmatic contributions from the EEFS tool. So just like AAEE, the same general elements are updated to capture fuel substitution impacts. Then we added the additional speculative fuel substitution from the FSSAT model, where additional fuel substitution is captured at a technology level for programs that are still in development. As can be seen here, for the Reference Scenario, we have not included any additional speculative fuel substitution. Then for all the other fuels in these sectors, like the minor fuels, like kerosene, LPG, we have relied on the PATHWAYS model.

Then moving on to the transportation sector. The baseline forecast energy demand is forecasted using models that incorporate consumer preference, regulations, econ demo projections, and improvements in technology, and other factors. So for the remaining sectors and for all the scenarios of our Demand Scenarios project, we have relied on the PATHWAYS model that was used for the 2020 CARB Carbon Neutrality Report. Next slide, please.

So the next few slides have the same structure as the Reference Scenario. I'll go

over a few key things to note. The first point being the baseline forecast here is adjusted to reflect more aggressive energy efficiency and expansive fuel substitutions than what we included in the Reference Scenario. So for energy efficiency, the baseline is reduced by savings from the electricity AAEE Mid-High Scenario 4, and the natural gas AAEE Mid-Mid Scenario 3. And for the portion of AAFS that comes from programmatic contributions we used Scenario 4.

Then lastly, the additional speculative fuel substitution, which we estimated using our FSSAT tool. We used this scenario based on proposed CARB measures for the 2022 State Implementation Plan for Residential and Commercial Buildings that quantifies the impacts of NOx control measures, which require sales of new electric water heater and space heaters in 2029 in the Bay Area Air Quality Management District and 2030 for remainder of the state.

So moving to the transportation, we started out again with our 2021 IEPR Mid Transportation Forecast and then layer it with CARB State Implementation Strategy for capturing

the incremental impacts here beyond the Referenced Scenario. So we used SIP which is based on CARB's proposed regulations for Advanced Clean Cars II for light-duty vehicles and Advanced Clean Fleets for medium- and heavy-duty vehicles. Next slide.

So just like the Policy/Compliance Scenario here, the baseline consumption forecast is adjusted for both energy efficiency and fuel substitution. So we are using scenario 6 here for AAEE, which is Mid-High Plus and natural gas. We kept it constant, and Ingrid will go over that, AAEE Mid-Mid Scenario 3. For the portion of the AAFS load modifier, we are going to use the higher scenario with the Scenario 6, and for capturing the additional speculative impacts of fuel substitution, we used CARB's Scoping Plan Scenario assumptions for alternative 4, which is carbon neutrality by 2045. So what the scenario assumes here, that is new residential and commercial buildings have to have all electric appliances beginning in 2029 for existing residential buildings, electric appliance sales ramp up to 100% by 2035, whereas for existing commercial buildings, electric appliances sales

ramp up to 100% by 2045.

Then for the transportation sector, we use the CARB Mobile Source Strategy for capturing the incremental impacts beyond the Policy/Compliance Scenario here. And just like the Policy/Compliance Scenario, the Mitigation Scenario uses increasingly more aggressive ZEV attributes and ZEV policies which Quentin will go over.

With that, I will hand off to Ingrid. That was my last slide for the Building Scenarios Framework. Thank you. Yeah, I think.

MS. RAITT: Commissioners, if you have any questions or we can just go ahead and go on.

VICE CHAIR GUNDA: Yeah, I don't. I don't.

MS. RAITT: Okay. Great. Thanks.

VICE CHAIR GUNDA: Not on the framing yet. Okay.

MS. NEUMANN: Hi, I'm Ingrid Neumann. Good afternoon, Commissioners and stakeholders. I will go into how we deployed the 2021 AAEE and AAFS forecast products as well as completed additional modeling to support the High Electrification Demand Scenario. Next slide,

please. Thank you.

These are the building components excerpted from the Demand Scenarios Framework Anitha just shared AAEE is Additional Achievable Energy Efficiency while AAFS is Additional Achievable Fuel Substitution. Next slide.

We are able to separate the electricity and gas components of AAEE and do so for the Policy/Compliance Demand Scenario in blue, and the Mitigation Demand Scenario in violet. Electricity and gas are however inextricably linked for AAFS, as gas technologies are displaced and substituted with more efficient electric technologies. The electricity demand is increased with fuel substitution while the gas demand is decreased. Next slide.

In addition to the programmatic fuel substitution contained in the AAFS scenarios, the Policy and Compliance, or Policy/Compliance and Mitigation Demand Scenarios also include additional speculative fuel substitution as modeled by our Fuel Substitution Scenario Analysis Tool or FSSAT. Those are in the pink outlined boxes. For the High Electrification Demand Scenarios project, we prioritize fuel

substitution over energy efficiency because the GHG impacts for fuel substitution are approximately four times greater than for energy efficiency. As shown at the bottom of the slide in the flowchart, we accomplished this by first removing the gas displaced by programmatic fuel substitution as quantified in the appropriate AAFS scenario from the baseline gas demands by sector and end use. Then we apply additional speculative fuel substitution modeled by the FSSAT. Only if gas demand remains after both types of fuel substitution are applied, do we apply gas AAEE savings on any remaining gas consumption by sector and end use. Next slide, please.

So for --

VICE CHAIR GUNDA: Just a -- just a quick question, Ingrid.

MS. NEUMANN: Of course.

VICE CHAIR GUNDA: On the previous slide. So just kind of making sure we -- we're kind of on the same -- all aligned on this. So the Reference Scenario is the baseline gas demand, right? So that's the first box here. And then there is some level of fuel substitution in the

Compliance Scenario along with some speculative elements?

MS. NEUMANN: So we go through -- so for the Reference Scenario in green, there is only the programmatic fuel substitution from AAFS Scenario 3. Then for the blue Policy/Compliance and the violet Mitigation, we go the additional step of taking out the slightly more aggressive and then the much more aggressive AAFS 4 and 6 programmatic, and then applying the SIP Plan and the CARB Carbon Scoping Plan, all four, as modeled by our FSSAT Tool.

VICE CHAIR GUNDA: Thank you.

MS. NEUMANN: All right. So for 2021, we utilized the same accounting aggregation and extrapolation methodology and tools as were established in previous IEPR cycles. AAEE is always updated every two years, so for more details the 2019 and the 2021 IEPR documentation can be consulted. Historical data and potential savings projections were updated in all of our existing workbooks, and some new workbooks were added based on recent programmatic activities. Next slide, please.

The largest change for AAEE in 2021 was

the explicit removal of any fuel substitution components because these efforts were supplanted by the new load modifier induced -- introduced in 2021 called Additional Achievable Fuel Substitution, or AAFS. We added the new workbooks listed here to quantify programmatic energy efficiency and fuel substitution impacts. Some of the programs had both energy efficiency and fuel substitution and we assigned them appropriately to either AAEE or AAFS. Important to the Demand Scenarios project is that we also extrapolated all of the potential AAEE savings and fuel substitution impacts out to 2050, so past the forecast period, which this time went to 2035. So we could support the entire Demand Scenarios projection time period with this work. Next slide, please.

We developed Additional Achievable Fuel Substitution, or AAFS as an annual and hourly load modifier to the Baseline Demand Forecast in 2021. AAFS was conceptualized as being separate from AAEE, though we did use AAEE as a template for developing AAFS. Next slide.

AAFS was developed in a public process with stakeholder inputs throughout the 2021 IEPR

cycle. As in previous AAEE forecasts, the objective of both AAEE and AAFS in 2021 was a continued focus on firm programs and projections because the core scenarios are used for planning and procurement purposes during the 2022 to 2034 or 2035 forecast period.

As in previous iterations, we developed variations around these most probable futures to show other possible outcomes given less or more input to realize the potential of existing or proposed energy efficiency and fuel substitution programs. This spectrum of scenarios from the 2021 IEPR was then extrapolated to 2050 and deployed in support of our Demand Scenarios work this year. Next slide.

The spectrum of the six scenarios, AAEE scenarios, is shown in the top row here with electricity savings on the left and gas savings on the right. For electricity, AAEE 3 is shown in green and was used for the Reference Demand Scenario and the slightly more aggressive AAEE 4 is used in the Policy/Compliance Demand Scenario, it is shown in blue. The Mitigation Demand Scenario uses the most aggressive AAEE Scenario 6, shown here in violet. AAEE 3 is used for gas

in all three Demand Scenarios, though it's only shown once in green on the top right. There are only five AAFS scenarios, 2 through 6 because we wanted to maintain the numbering so that 3 would be the Mid-Mid, or the business as usual type Reference Scenario. So those five AAFS scenarios electricity and gas impacts are shown on the bottom two graphs. AAFS 3, again in green, is used for reference demand -- for the Reference Demand Scenario. AAFS 4 in the bright blue is used in the Policy/Compliance Demand Scenario and the most aggressive AAFS 6 Scenario in violet is employed for the Mitigation Demand Scenario.

The electricity impacts are shown here as negative because we are examining the programmatic contributions from a savings perspective. And while we are indeed quote/unquote saving gas by displacing it with fuel substitution, we are simultaneously adding some electricity consumption. Next slide.

Finally, for the Policy/Compliance and Mitigation Demand Scenarios, we developed additional speculative fuel substitution using our Fuel Substitution Scenario Analysis Tool, FSSAT. This is considered because programmatic

fuel substitution may not be of the magnitude needed to meet various policy goals. First, programmatic fuel substitution is input into the FSSAT to determine what available gas displacement remains. Then we are able to add speculative or what-if technology based fuel substitution to show what additional types of efforts might be developed to reach these goals. The FSSAT inputs are given as percentages of new construction, percent of replacement burnout, ROB, and for percent of early retirement, or RET, by sector and end-use.

For the Demand Scenarios projects we modeled the potential impacts from CARBs proposed SIP, that's the State Implementation Plan, restriction on NOx emission limits, which would restrict the sales of equipment for residential and commercial space and water heating in California. That's in the first row of numbers here with the time series and the percentages. The proposed sales restriction would go into effect statewide in 2030 and effectively limit sales of these equipment types to electric technology. This would mean 100% of new construction and replace on burnout would be

electric, but there would not be a direct impact motivating any early retirement of existing gas technology. That's why we didn't include any percent early retirement in this model.

There is a second line in the input specific to Climate Zone three because the Bay Area Air Quality Management District is proposing to implement these sales restrictions one year earlier or in 2029. So that's why those 100% are highlighted in the two different years and then carried forward out to 2050.

Next we modeled the potential impacts from CARB's Scoping Plan Alternative Scenario 4 for use in addition to AAFS 6 in the Mitigation Demand Scenario. This scenario assumes all electric equipment sales for residential and commercial space and water heating end uses starting in 2029, but just similar to the SIP. But then it also extends all electric sales for equipment in all other residential and commercial end uses. A 75% electric equipment sales assumption is applied for 2030 for both residential and commercial sectors, which quickly ramps up to 100% for residential in 2035 and more slowly for commercial in 2045. Next slide,

please.

These graphs show the results for the additional Fuel Substitution model using our FSSAT based on the SIP assumptions in bright blue for the Policy/Compliance Demand Scenario, and the Scoping Plan alternative for assumptions for the Mitigation Demand Scenario in violet. The Alternative 4 scenario is more aggressive, but a significant amount of gas is already displaced from the most aggressive programmatic fuel substitution AAFS 6, in the sectors and end uses it applies to. So that means that around 2040 less gas is present in that Mitigation Scenario for additional fuel substitution as modeled by the Scoping Plan. Next slide.

So this slide once again summarizes the high level approach we took in assembling the programmatic AAEE and AAFS contributions and modeling additional fuel substitution using the FSSAT. Fuel substitution is prioritized over energy efficiency as shown in the flowchart applying gas energy efficiency last. Programmatic fuel substitution is applied prior to allowing additional fuel substitution using the FSSAT, and in our blue Policy/Compliance and

violet Mitigation Demand Scenarios, this results in not all gas AAEE being realized slightly prior to 2040 because simply too little gas consumption remains after both fuel substitution efforts. So final slide.

This final slide depicts the energy efficiency and fuel substitution results for each of the three Demand Scenarios for electricity on the left and gas on the right. In both, energy efficiency is shown with solid lines, with round markers, while fuel substitution is shown with dotted lines and triangular markers. We focused, of course, on fuel substitution and modified the gas energy efficiency contributions when gas displacement potential was reached. Hence, the adjusted AAEE values and gas savings for the Policy/Compliance and Mitigation Demand Scenarios in the gas saving side here in blue and violet.

As expected, the scenarios became more aggressive, moving from Reference in green, to Policy/Compliance in blue, and Mitigation in violet. Though the gas displacement in the latter two from energy efficiency alone is not significantly different, these fuel substitution impacts are. Thank you.

VICE CHAIR GUNDA: Ingrid, can I just ask a quick question? Could we just go back to the summary slide real quick? I'm going to note this later, but just thank you so much for all this work. I -- this is incredible amount of work and I just want to thank you, Mike and Anitha and Quentin, just the amount of work that took to conceptualize this and work through all the elements, it's just incredible. So thank you. Thank you all for all the work.

On this one I just want to make sure, you know, given that in a lot of the public are looking at this slide for the first time and I had the chance of being briefed multiple times and thank you for that. So just kind of going through that. On the left, for example, just the electricity side, the blue solid dotted line is the Reference Scenario 3, or it's the green?

MS. NEUMANN: The green.

VICE CHAIR GUNDA: So green is the Reference. And then what's the -- can you just kind of expand on the six? Like what are the differences in each of those lines as you're moving through one by one?

MS. NEUMANN: Right.

VICE CHAIR GUNDA: Just contextualize for the broader public that are in attendance.

MS. NEUMANN: Right. So the positive values on the gigawatt hours, those are energy efficiency savings. So that would be a demand reduction, right. So those are the solid lines on the round markers and then the negative values on the gigawatt hours are the fuel substitution impacts where we're actually having quote/unquote negative savings. So we're adding some electricity, right, because that's because of fuel substitution. The green is always the Reference Scenario. The bright blue is the Policy/Compliance Demand Scenario, which includes, you know, some more optimistic views of existing programs and some that are, you know, just being developed. And then the violet is the most aggressive view, including for fuel substitution, the SIP plan and the -- sorry, the SIP plan for the blue and the CARB Alt 4 for the -- for the Mitigation Scenario. So those are not -- they're proposed at this time.

And then on the right hand side, all of the values are positive because whether we're actually saving consumption by simply using less

gas because of energy efficiency measures, those are all the lower values with the round dots again. And we really only see the violet one from the Mitigation and then the blue is almost the same, except for the one dot before 2040. And that's because we favor fuel substitution over energy efficiency. And then you can kind of see that if you didn't have as much fuel substitution and just perpetuated gas energy efficiency, that that, the Reference, the green line right, which is AAEE 3 or Mid-Mid AAEE 3 would follow out to 2050. But that magnitude is far less than how much gas would be displaced with fuel substitution. Right. So just in the Reference case with the programmatic fuel substitution, in 2050 you see the value is far below. Like it's what, maybe 1500 MM Therms. The blue and the violet values at the top of the page where the violet one's almost touching 6,000 MM Therms, and so the fuel substitution definitely displaces more. And has higher GHG impacts because of that.

COMMISSIONER MONAHAN: That was really helpful. Thank you. Can I ask a question since Vice-Chair Gunda has a little edge over me on

this. So can we go back to Slide 9, that Statewide Spectrum of 2021 AAEE and AAFS scenarios? Yeah.

COMMISSIONER MONAHAN: Just so I understand, I totally get the 2021 IEPR gigawatt hours savings. That's pretty clear. When it goes -- Oh, I'm supposed to start my video. Sorry about that. When it goes to the 2021 IEPR gigawatt hour impacts from a AAFS, I'm a little confused about that one. So we're talking about we're fuel substituting will be increasing the amount of electricity we're using. So the impacts, gigawatt hour impact, shouldn't that be positive?

MS. NEUMANN: So we would -- we were looking at it from a savings perspective, right.

COMMISSIONER MONAHAN: So it should -- maybe that should say gigawatt hour savings, which is negative. Do you know what I mean?

MS. NEUMANN: Right and that’s --

COMMISSIONER MONAHAN: Because the gigawatt hour impacts are actually positive. And I got confused because I was like --

MS. NEUMANN: That’s why I called it

impacts and not savings.

COMMISSIONER MONAHAN: -- aren't we electrifying so shouldn't it be higher?

MS. NEUMANN: Yeah.

COMMISSIONER MONAHAN: Okay. Excellent.

MS. NEUMANN: Yeah. So if you're not saving, they're negative savings.

COMMISSIONER MONAHAN: Great. For those of us that are not in the weeds on this. And then I guess similarly the -- just so I understand, it's really clear like the 2021 IEPR Therms savings from energy efficiency. Of course, that's positive. And then the 2021, the last one where it's the savings impacts, can you tell me what is -- what's the difference between savings and savings impacts?

MS. NEUMANN: Right. Okay. So basically savings, we've always been looking at energy efficiency savings. Right. And that, of course, would be subtracted from the consumption or the Demand Forecast. Right?

COMMISSIONER MONAHAN: Right.

MS. NEUMANN: So even though we're saying it's a positive value here, it doesn't always subtract it. So then for Gigawatt

hours --

COMMISSIONER MONAHAN: Right. So it's just the nuance of like, okay.

MS. NEUMANN: Yeah, we're subtracting a negative and --

COMMISSIONER MONAHAN: Right. And you're adding two things together, right? You're adding like electricity use and whatever fuel you're substituting, probably natural gas, but it's the total amount of energy from those whatever the fuel substitute, the fuel that is substituted, that's -- anyway.

MS. NEUMANN: Yes, and we would have to convert --

COMMISSIONER MONAHAN: It's the difference between --

MS. NEUMANN: -- units.

COMMISSIONER MONAHAN: Yeah.

MS. NEUMANN: Yeah.

COMMISSIONER MONAHAN: Okay.

MS. NEUMANN: Yes. So --

COMMISSIONER MONAHAN: It's the amount of overall energy saved from fuel switching.

MS. NEUMANN: Yes.

COMMISSIONER MONAHAN: So in other

words --

MS. NEUMANN: So, that's not apparent here. Right?

COMMISSIONER MONAHAN: Yeah.

MS. NEUMANN: So there's just I tried to use impacts for fuel substitution and savings for actual energy efficiency savings. You could argue that for fuel substitution you are saving gas, but it may be more like you're displacing it because you're using electricity instead, but then are you --

COMMISSIONER MONAHAN: But it’s more efficient.

MS. NEUMANN: Right. But are you saving overall energy? Right?

COMMISSIONER MONAHAN: Yeah.

MS. NEUMANN: Is it actually more efficient? And that's not apparent here, but yes, it is. So if we convert all of this to combined units of BTUs, we could see that yes, it is overall.

COMMISSIONER MONAHAN: Overall energy saved from -- okay.

MS. NEUMANN: Yes. NGHG reduction. Yes. Very much so.

COMMISSIONER MONAHAN: Got it.

MS. NEUMANN: Mm-hmm.

COMMISSIONER MONAHAN: Thank you.

MS. NEUMANN: Yes, of course.

VICE CHAIR GUNDA: So Ingrid, just one more question. And I know Commissioner Monahan kind of jokes about GH, but she kind of asks really good questions. So I want to just make sure at the end of the day though, we need to sum these things up for the net impact.

MS. NEUMANN: Anitha's got that.

VICE CHAIR GUNDA: Okay, so you guys are going to kind of cover later in the net impact that we're going to basically have to sum these things up into the -- into the overall scenario.

MS. REDNAM: Yes. Like, for example, for residential and commercial sectors, Ingrid sent me her values for AAEE and AAFS. I applied them for both the electricity and natural gas and like she said, subtract the efficiencies for -- from the baseline consumption, add the AAFS and I sent those numbers to Gabe, which he will cover in his presentation, and then he added his for the other sectors, and then we generated the complete scenario and we see -- can see the results in his

presentation.

VICE CHAIR GUNDA: Yeah I would -- I would just recommend that we in the, probably another summary slide, of just showing just the net impact of the building sector.

MS. REDNAM: Okay.

VICE CHAIR GUNDA: That probably would be helpful.

MS. REDNAM: Okay.

VICE CHAIR GUNDA: Because I think that's where --

MS. REDNAM: Yeah. We can do that.

VICE CHAIR GUNDA: Commissioner Monahan was also going.

COMMISSIONER MCALLISTER: Can I -- can I ask a quick question? So sorry I missed. I had to step out there for a second, but so but I got briefings on this before so I feel like I'm roughly up to date. I guess I have a couple of questions. So did -- are you -- so maybe you've updated the scenarios and so I just wanted to check. You know in the AB 3232 assessment, we actually had a scenario for kind of standard old heat pump upgrades. You know, fuel switching, fuel substitution and then another scenario

alongside of that, which was what would happen if we focused on the most efficient heat pumps, and like we really used cutting edge technology and took advantage of that inherent efficiency to the max from heat pumps versus, you know, a furnace or a gas fed water heater. So have you built sort of relative efficiency into the fuel substitution scenarios at all?

MS. NEUMANN: So the -- it does have a mix of efficiencies. We removed anything that was not more efficient. Right. Than standards.

COMMISSIONER MCALLISTER: Yeah. So they, I mean they have to be at least minimally efficient.

MS. NEUMANN: Mm-hmm.

COMMISSIONER MCALLISTER: Complying with federal standards. Right?

MS. NEUMANN: Mm-hmm.

COMMISSIONER MCALLISTER: But I think if we wanted to find programs that really move the needle even more, piggyback on that --

MS. NEUMANN: Mm-hmm.

COMMISSIONER MCALLISTER: -- investment that people are going to be making in heat pumps, we could sort of really move towards the

efficient end of the spectrum and get even more benefit that would have lower impact on, you know, for the same service, lower impact on the -- on the grid, but at the same, you know, would avoid the same greenhouse gas reductions from the gas side.

MS. NEUMANN: Right. One could do sensitivity scenarios like that.

COMMISSIONER MCALLISTER: So yeah, just something to think about going forward.

MS. NEUMANN: Mm-hmm.

COMMISSIONER MCALLISTER: Let's see. And then also, I guess this isn't quite within your brief, but I guess just suggesting maybe going forward, you know, since we're going to be looking at implementing, very likely getting significant resources to implement programs that actually incentivize or encourage Californians to replace their gas fired devices with heat pumps, that will have an affordable focus, which means necessarily that it'll be -- it'll have a geographical focus and so I'm sort of wondering on the planning side of things, how much -- well, for the future, it seems like, since we're talking so much about DERs and really trying to

move, you know, end-use technologies in a big, big way in the state and are going to be doing that for decades, putting the tools together to be able to drill into the distribution grid and kind of, or at least sort of get more granular than just, you know, utility service territory might be a good idea to build those tools as well.

So I'm wondering if anyone's thinking about that. Ingrid, or Anitha, or Mike.

MS. NEUMANN: We're always thinking about it, right?

COMMISSIONER MCALLISTER: Yeah.

MS. NEUMANN: It's often depending on what type of program as far as the granularity, you know, determines what type of granularity we can get.

COMMISSIONER MCALLISTER: Yeah. Yeah.

MS. NEUMANN: So we are -- we have some plans for some additions, at least for building standards.

COMMISSIONER MCALLISTER: Mm-hmm.

MS. NEUMANN: Because we can get some more detail there. Other things are in the works, right?

COMMISSIONER MCALLISTER: Yeah. Okay. I mean, local building codes are going to influence that. I mean, actually, looking at Commissioner Monahan, I mean, transportation between electrification of transportation and buildings, different parts of the state are going to adopt at different rates. And so that distribution level assessment is, I think, going to be pretty important. And we get questions about that. Can the electric grid handle this electric load? Right? And so I think it's important to start to answer that.

MS. NEUMANN: Right. I mean, what I thought was interesting and I mean, you'd really have to look at hourly.

COMMISSIONER MCALLISTER: Yeah.

MS. NEUMANN: And Mike will go into that a little bit for the other project. But what I thought was interesting on an annual level with the Mitigation Demand Scenario, just for buildings if I pulled together the most aggressive energy efficiency and the fuel substitution, the AAFS 6 as well as the CARB Alt 4 modeling in the FSSAT, it only added like 1% total.

COMMISSIONER MCALLISTER: Yeah.

MS. NEUMANN: So that was kind of, you know, of course the time matters as well, but it's encouraging.

COMMISSIONER MCALLISTER: Yeah. And if we also make sure that these heat pumps are load flexible and can --

MS. NEUMANN: Right.

COMMISSIONER MCALLISTER: -- you know load management standards and can opt into the alt programs and that kind of thing and take advantage of some of these tariffs that we could actually, you know, not really impact peak loads at all. At least that would be the hope, obviously. So anyway. We're all -- yeah we're all --

MS. NEUMANN: There's hope.

COMMISSIONER MCALLISTER: I think seeing new analyses on the horizon all the time. So I don't want to overload you. But yeah, thanks for this work. I really -- it's great to see it moving forward and I know you're doing a lot of deep thinking about these scenarios, so I appreciate the output. Thank you.

MR. JASKE: Commissioner McAllister,

back to your very original piece of your questions. We have explicitly modified the FSSAT tool between the generation used for AB 3232 and the current one to separate out the low income portion of residential from overall residential, because we anticipate there are many of these equity issues that that's going to be important. I won't say that we have got all the data neatly segregated as well because there obviously are different appliance holdings and different traditional efficiency choices between low income and sort of ordinary citizens, but the structure is there to help illuminate the scale differences between low income residential and the rest of residential.

COMMISSIONER MCALLISTER: Thanks a lot, Mike. And, you know, as we get this responsibility from the governor and the legislature to implement programs with significant resources with an affordable, you know through an affordable lens, with an affordable focus, the targeting, the sort of slicing and dicing, you know, demand and overlaying with demography, and climate, and you know heat impacts, and fire, and all that is

going to be really important, I think, to at least get a first, second, third cut of what parts of the state and what communities are likely to be the focus or ought to be the focus of those resources. So this this conversation is really vital, I think, in the sort of near, medium and long term, actually. So I appreciate that and it's great to know you're thinking about that as well. To know that you've built that capability, rather. So thanks.

VICE CHAIR GUNDA: Just one kind of one additional question, kind of teeing off from Commissioner McAllister's kind of line of thinking there. I mean, we don't -- we don't need to kind of discuss this at large today, but kind of just flagging it, as I wonder, given the large amount of investment that might be put into low income, specifically, you know, that the opportunity for potential market transformation rate and what that does in terms of accelerating some of our goals and some of the electrification overall and how do we capture that better moving forward? Again, this is a lot of work. I'm just kind of flagging that as an opportunity.

And the other question I'm just kind of

thinking through, do we -- how are we handling behind the meter over time in terms of either behind the meter solar or storage, you know, in terms of, I mean I thought of the Demand Forecast, because we're taking the managed, we have a certain level of behind the meter solar and storage. Right? So what are we doing for those elements over time in the Mitigation Compliance Scenarios?

MS. REDNAM: So Vice Chair Gunda this is a question for Gabe, because we have used E3s model for behind the meter and the other stuff?

MR. MANTEGNA: Yeah, sure. So everything shown here is just consumption, right? So before subtracting any of that, right. And I believe we just aligned with everything that's used in the CPUC IRP for all the behind the meter stuff. So I think it's just all the PV that's built into the Standard IEPR Forecast is what we're used, yeah.

VICE CHAIR GUNDA: So there isn't any additional -- so I'm just kind of thinking through that in SB 100, for example, we've taken the Reference Scenario, which is with the Demand Forecast.

MR. MANTEGNA: Mm-hmm.

VICE CHAIR GUNDA: And we basically took the behind the meter solar and then extended it all the way to 2045.

MR. MANTEGNA: Mm-hmm.

VICE CHAIR GUNDA: I believe it was about 30 gigs of behind the meter solar.

MR. MANTEGNA: Yep.

VICE CHAIR GUNDA: So in terms of -- so we are using that?

MR. MANTEGNA: Yes.

VICE CHAIR GUNDA: Okay. And nothing incremental to that.

MR. MANTEGNA: Nothing incremental. Yeah, exactly.

VICE CHAIR GUNDA: Thanks.

MS. RAITT: Okay. Thank you. Ingrid, are we ready to go on to Quentin Gee on Transportation? Thank you.

MR. GEE: Good afternoon, Commissioners. Just waiting for -- sorry my screen's -- okay. All right.

So we have the slides ready to go. Good afternoon. My name is Quentin Gee. I'm the supervisor for the Transportation Energy

Forecasting Unit. And, yeah, we're going to discuss the transportation approach to the 2050 scenarios.

So on this slide, we can see our time frame is 2022 to 2050, and we have our three different approaches, as Anitha laid out before for transportation. We have our Reference Scenario. We have a Policy/Compliance Scenario, and then our Mitigation Scenario. I'll explore these a little bit more in detail. But basically what we do is we take the general model approach is that we take different vehicle populations and run those through. So we have certain models or assignments that we use to determine vehicle populations. And then from there, those go into our vehicle miles traveled models and then into our energy consumption calculations. From there, E3 takes on the greenhouse gas modeling from there. Next slide, please.

So looking at the Reference Scenario, we can see more or less that the sort of just the baseline scenario that we had from our adopted managed demand forecast, only what we did is we extended it to 2050. We had certain things such as vehicle for light-duty and heavy-duty, we had

vehicle attributes sort of extended out further beyond their typical endpoint. You know the forecast generally ends at -- the forecast from 2021, from the 2021 IEPR, ends in 2035. And so what we did was we just extended those to 2050 with the sort of curves that we had for certain vehicle attributes, particularly vehicle price.

And then what we did is we sort of built from there. We did have certain existing regulations and incentives in place, but these are very modest compared to what is on the near horizon and in the future. We have the, or relatively modest, right. We have the Hybrid and Zero-Emission Truck, Bus and Bus Voucher Program. We have the Clean Vehicle Rebate Program, the Advanced Clean Trucks Rule, which is a rule on truck manufacturers. And then we have Advanced Clean Cars I. Advanced Clean Cars I was a regulation that only goes to about 2025 from CARB. Next slide.

So with that Reference Scenario in place, we kind of want to ask ourselves, you know, what is going to happen, you know, beyond that, above that, from what we can see in terms of near-term policy goals that are policies, that are likely

to pass in the near future. So what we did is we took a look at two major policies that are expected to have a significant impact on vehicle adoption rates. So we took a look at Advanced Clean Cars II, which is a CARB regulation that will require 100, or that will incrementally increase the percentage of zero-emission vehicles required by OEMs, or original equipment manufacturers, to, they have to increase their ZEV credit system to approach 100% new ZEV sales by 2035. Currently we're looking at about 12 and a half percent sales, ZEV sales, in 2021 and that trend seems to be continuing upwards, but the ACC II regulation, which starts in 2026, will continue to require more ZEV sales on the part of OEMs.

We also have the Advanced Clean Fleet requirements. The Advanced Clean Fleet requirements are a little bit different. These are on the fleet operators. That requires them, depending on the vehicle classification in question, you know, you could talk about, say a van, you know, required to be a zero-emission vehicle versus a class 8, you know, semi-truck. So they have different targets depending on the

years, the duty cycle. Like, where are these trucks operating and what are they doing? But you know, various different requirements that we have in there from the CARB Advanced Clean Fleets requirement, but again approaching 100% ZEV sales in various years.

Then on the next slide, we can see the Mitigation Scenario. The Mitigation Scenario, basically it's roughly a cut and paste of what CARB puts forward in the 2020 Mobile Source Strategy. Again, this is in terms of the vehicle populations. What we do is we take in the light-duty case, we basically just assigned what CARB had in its -- in its Mobile Source Strategy up through 2034. And then in 2035, our vehicle models, basically the sales that are introduced in that model were assigned to be 100% ZEV.

And again in for the medium- and heavy-duty case, a similar framework although more aggressive adoption rates in the Mobile Source Strategy compared to the Advanced Clean Fleets rule. Next slide.

So before we get into the main results, there are some just general policy takeaways that we can think about. We don't have as much

clarity on the light-duty policy needs from these scenarios. The limitation there is that we took the assigned populations determined by CARB and sort of inserted them into our model framework. But one of the reasons why we did that is because our current models were not able to produce the kinds of results we were looking for. So that suggests that there, for us, that there is a need for continued incentives for vehicles. At the same time, there's some uncertainty there because, you know, preferences change, prices change in ways that we can't always predict, as the last few like month and a half have shown us different oil prices, material prices. These things can be quite in flux. But we do think that there still is some, probably some strong need for continued incentives, but yeah, some uncertainty around there.

With medium- and heavy-duty it's a little bit of a different story. Of course, there's some uncertainty there associated with vehicle prices, but we also -- and so we think that there might be some need for incentives. But one other significant thing that we realized we would most likely need, or you know potentially need here,

is vehicle retirements. These are basically kind of, you know, years where we say, okay, any truck of this age or older, you're out and got to get some more -- some new ones. And these are going to need to be ZEVs most likely, depending on the year and the vehicle in question. But those accelerated vehicle retirements were something that our models needed to get to the results we need -- we wanted to see in the both cases, both scenarios.

The last thing, and E3 will touch on this a little bit, is that aviation fuel remains a greenhouse gas concern. This is one of the areas where our model is not as sophisticated. And, you know, there's a lot of uncertainty about what that area looks like, but that could become an increasingly important and salient feature of greenhouse gas analyses when we look into the future there. We probably are going to want to look at some kinds of solutions on that front and quickly, because they quickly turn into the major source of emissions for transportation several years out.

On the next slide, we can see kind of the main results from this. The Reference Scenario,

again, one thing to clarify here, I put little dashed lines here in 2035, which is a common reference here, the 100% Executive Order N-79-20 100% ZEV sales goal is that year and it's kind of a good midpoint-ish for us. So the dashed lines, the dashed vertical lines show us the year 2035 and then we can sort of see how the Reference Scenario looks, which is not particularly, yeah, not -- it doesn't look all that inspiring, I guess.

But then we have the Policy/Compliance Scenario and then we have the Mitigation Scenario where we can see some accelerated ZEV adoption in this case for the light-duty sector. I've also added in some dashed lines here for 5 and 10 million vehicle stock. And you can see that the Policy/Compliance case versus the Mitigation case, so looking at the center versus the right, we can see that there's a little bit more going on in the Mitigation case. It's a little bit harder to see without these dashed lines. But basically our ZEV stock in the bottom, we can see under the Reference case, 5.4 million in 2035, approaching 10 million in 2050. But then in the Policy/Compliance and the Mitigation Scenario, we

can see 12.8 million and 31 million for the Policy/Compliance, and then Mitigation we see a higher 2035 year, approaching 15 million ZEVs on the road. I think that's it for this one.

On the next -- one thing to keep in mind, one last thing to keep in mind is basically, again, maybe just to reiterate this point, 2035 -- 2034 is the year where we kind of have the CARB vehicle assignments. And in 2035, that's when our model and our new vehicle sales component of our existing models kicks in at 100% ZEV. So this would likely be something that if you were to compare with the way CARB has it, if they have any projections out to 2050, it would look a lot different, but it should look exactly as CARB does, at least the ZEV stock levels should look exactly as CARB has them up to 2034. Next slide.

Here we can just take a look at how these scenarios stack up with each other, just in terms of ZEVs. There's not a whole lot different in this from the previous slide, but here we can sort of just zero in on the ZEV stock numbers. Here we can see that the Reference case, again, kind of fairly linear and then the

Policy/Compliance and Mitigation really ramping up, but the Mitigation case ramping up a little bit more aggressively in the near-term. So there's, even though it doesn't look like there's a huge difference between them and they appear to converge, there is a sort of similarity or excuse me, there is a good early-term difference here, and that could be somewhat significant in terms of emissions as well. Next slide.

Here we can see the MDHD stock results as well. So these are the vehicles on the road for the medium- and heavy-duty case. The Reference Scenario is kind of, you know, you can see here that basically ZEVs kind of appear to just roughly just sort of replacement. You know, we expect the economy to grow. We expect there to be more vehicles on the road. And it's just kind of roughly kind of like for each new vehicle added on the road, they're just kind of ZEVs, more or less. I mean, obviously, there's different fluctuation going on there. But you know, we still have a lot of ICEs in 2050 under the Reference case scenario.

But then we can see under the Policy/Compliance Scenario, we have Advanced

Clean Fleets kicking in here. One little thing that viewers might be able to see in this middle Policy/Compliance chart here is there's a little tiny dip here from 2030 to 2031. That represents a -- an early retirement program where a bunch of vehicles are forced to retire, to be replaced with ZEVs.

And again, in the Mitigation case, you can see here, the Mitigation case does have more aggressive incentives as well, but also does need a couple of early vehicle retirement situations happening from 2025 to 2026 and then at 2030 to 2031 as well. That allows us to approximate the CARB vehicle targets using our model. Next slide.

VICE CHAIR GUNDA: Hey Quentin.

MR. GEE: Yeah.

VICE CHAIR GUNDA: Quick question on the previous one.

MR. GEE: Mm-hmm.

VICE CHAIR GUNDA: So just kind of the what is the technology mix when we talk about ZEVs. Is it -- what's -- I mean, are you going to discuss that in your slide deck or?

MR. GEE: Yeah. Primarily, yeah that's

not actually in here. Primarily what's going for medium- and heavy-duty?

VICE CHAIR GUNDA: Yeah.

MR. GEE: It's primarily BEVs, but as I think 2030 approaches, maybe a little bit sooner than that, we do see some fuel cell electric vehicles coming into the market. You know, those tend to be more in the heavier-duty class 8 type range because that's where I think the cost case is. As with the information we have now, that's where they're most likely to be penetrating first. But I don't have precise numbers on that. Do you want me to look those up? I might have some.

VICE CHAIR GUNDA: No.

MR. GEE: Mm-hmm.

VICE CHAIR GUNDA: Just kind of curious. Kind of just thinking this through on an energy balance, you know, depending on how many fuel cell vehicles we might have, you know, again, the green hydrogen to the electricity load.

MR. GEE: Mm-hmm.

VICE CHAIR GUNDA: Just wanted to make, I mean just flagging for myself as like how we are considering all the interactive effects.

MR. GEE: Yeah. Yeah. I don't know the exact fuel mix breakdown. Hydrogen does remain a somewhat small proportion of total zero-emission vehicle fuels. But yeah, we also, just to be clear, we don't include electricity. We include electricity for charging the -- for charging battery electric vehicles or plug-in electric hybrid electric vehicles. We don't have electricity, say for electrolysis associated with producing hydrogen. So that is something that I think would be something for us to explore in the future. But yeah, it does take a good amount of electricity to make the hydrogen, which is incorporated here. Yeah.

Okay. Next, yeah. I think this is it. Yeah. So here we can look at the Transportation Energy Demand from Combustion Fuels. Here we've got natural gas, diesel, gasoline. And again, the Reference case, kind of the mirror of the two, where if you have a lot of internal combustion vehicles, you're not going to see the kind of decline that you would see. These vehicles do become more efficient over time, so you do see a bit of a decline in combustion fuels and a bit of increased penetration for ZEVs. But

we still have a lot quads, or quadrillion Btu of energy consumption from these fuels.

If you look at the Policy/Compliance and the Mitigation however, you can also -- you can see that those combustion fuels do decline significantly. The Policy/Compliance case, you might notice that that actually kind of shoots above the Reference case. The reason for that is because we did the CARB assignment of vehicles and currently ACC I, or Advanced Clean Cars I, is not -- the market appears to have overshot that regulatory requirement. So if we stick with just what the regulation says, then we're going to have fewer BEVs, or whatever BEVs on the road and more ICEs. So yeah, so that's a little fuzzy there that might not match, you know, but just as a scenario, that's kind of what it could look like. Mitigation rapidly does shoot down with the combustion fuel so. Next slide.

We can see --

VICE CHAIR GUNDA: Just one thing on this one.

MR. GEE: Yeah. Mm-hmm.

VICE CHAIR GUNDA: I think this is, again, a flag for us to think about. So I'm just

going to -- my mindset has been reliability and emergency planning. So given that California is largely kind of an island in terms of refining capacity -

MR. GEE: Mm-hmm.

VICE CHAIR GUNDA: -- I think it's important for us to track the gasoline and other fuel side of it, to understand the refinery margins we have in California, like our peak demand. I think it's important from tracking kind of the price impacts, you know, on the gasoline and diesel overtime. So just kind of understanding the ramp, right. So we have the same thing on the electricity side where we want to rapidly decarbonize the grid, but we want to ensure the reliability of supply. And how do we think about as we decarbonize, especially the transportation sector in the LDV side, you know, what does that do to in California capacity of fuels and how does that -- are we situated well to ensure that the transition is happening reliably from a supply side.

MR. GEE: So are you thinking in terms of electricity, Commissioner, or are you thinking about --

VICE CHAIR GUNDA: The fossil side too.

MR. GEE: The fossil side. Okay. Yeah. That is an important challenge. I mean, if demand drops, you know, I'm not sure what CARBs goals are in terms of production of gasoline, let's say. But that certainly is something here that it looks like demand could drop quite a bit. And the impacts associated with just fewer cars needing gasoline, that's uncertain. Something for us to definitely take a look at.

COMMISSIONER MONAHAN: Well I also think it might be, I mean, I'm taking us too much down a rabbit hole on this one. It might be worth a separate workshop on this, but I mean, refineries are making choices about how much to manufacture diesel versus gasoline versus other products. And we're seeing refineries close or converted into biofuel facilities. And some of these choices around, you know what refineries are doing are so far out of the modeling that we're doing here, that and those, I think, are what's driving the cost impacts to Californians today.

So I would just think we might want to consider separating out the production of these, of gasoline and diesel mostly, and the price

impacts and the constraints that we're facing in California from this modeling. They're related. But the choices that these refineries are making are, you know, that's why the price of fuel is so high.

MR. GEE: Yeah.

VICE CHAIR GUNDA: So, yeah, just kind of kind of thinking that through I think that's exactly kind of the point on how do we send this the signal, right? I mean, like, how do we at least for situational awareness, what is the demand going to look like? And is there a conversion or kind of a closure of refineries comport with that. If not, you know what are the mitigation strategies for California in ensuring adequate supply? Right? So there are other strategies that we could pursue. But I can I think flagging those things would be really helpful during this transition. I think those transitional issues.

MR. GEE: Okay. Yeah, definitely some questions that we need to explore there. Yeah. You know, as a global commodity, it's, you know, kind of tied into all this. But yeah, the refineries and what are their plans if, you know,

if this starts to come to fruition, then the reduction in demand from that could have impacts on in-state production of the fuels or processing of the fuels into combustion -- into fuel products for vehicles. Yeah. Great. I think next slide.

Here is sort of, again, the sort of inverse of this. You're looking at gigawatt hours. This is -- this is electricity. This, again, does not include any potential electricity from electrolysis associated with fuel cell electric vehicles. And we do have some fuel cell electric vehicles in light-duty and in the heavy-duty as well in the population. So their, that zero-emission vehicle energy consumption is, or demand, is not shown here.

But we can see sort of lock and step with the rest. We do see an increase in electricity demand. It's hard to know the exact, you know, future on this, but this does represent a very large proportion of current in-state electricity demand. I think we are around, I can't remember the exact number, but I think approaching around 300,000 gigawatt hours statewide. And so 2050, 200,000 is a lot of electricity. At the same

time, it's not like that needs to happen tomorrow. So but it is something for us to keep in mind about the energy impacts from increased electrification of transportation.

And I think that is it for my presentation. Thanks.

MS. RAITT: Great. Thank you so much, Gabe. So next we have Gabe Mantegna from E3. So go ahead, Gabe.

MR. MANTEGNA: You can go ahead to the next slide, please. So good afternoon, everyone. My name is Gabe Mantegna. I'm a senior consultant at E3. And so what I'm going to be talking about now is putting all of these energy demands together and then adding them to other energy demands that weren't modeled. So, for example, like the minor fuels, and press and comm, and industry, and agriculture, and then adding everything all together and then seeing where we get in terms of emissions.

So as far as my presentation goes, I'll be talking first a bit about the motivation and the context here and then I'll talk a bit about what the PATHWAYS model is and how it works. I'll talk a bit about the scenario assumptions to

be used in PATHWAYS, and then I'll talk about our results. So you can go to the next slide, please. Yeah.

So why are we even using PATHWAYS here? Right. So what we're doing in PATHWAYS is what we have from the IEPR Demand Scenario side is indicated in this dotted box on the left here of the graphic. And so what we have coming from the CEC side is just energy demands for residential, commercial, and transportation. But it's actually a relatively small part of the overall economy wide picture here. So what we do in PATHWAYS is we're adding an energy demands for industry, agriculture and other minor fuels. And then, as indicated by the middle box here, we're then adding in emission factors via assumptions on things like biofuels and electric generation, and then we're also adding in non-energy emissions. And then we can look at then what the overall economy-wide picture looks like in terms of emissions. You can go ahead to the next slide, please.

So what is PATHWAYS? PATHWAYS is an economy-wide, bottom-up model of energy demand and emissions. And a very important thing to

understand about PATHWAYS is that it is very much a user defined scenario tool. So contrary to the CEC modeling that is used here, it's not intended to be a forecast of impacts of any policies. It's much more of a what-if scenario tool, right? The thing that is different here is that we are actually directly plugging in those inputs from the CEC's modeling for residential, commercial and transportation. So it's only the other sectors where we really are using the main PATHWAYS model.

So what PATHWAYS is used for generally as it's used to evaluate the emissions implications of various infrastructure transformation trajectories. So a kind of question that PATHWAYS would be able to answer is something like what's the impact on emissions if you had 100% sales of light-duty vehicle EVs by 2035? It's not intended to ask what is the most cost optimal PATHWAY? It's more of just comparing different scenarios.

And then on the right here, I just have a schematic of how at a pretty high level how pathways works. So first we have our energy demand module, which adds together all of the

energy demands from the different subsectors. And then we have our energy supply module which adds emission factors via assumptions on biofuel blending and electric sector emissions. And then we add all of those things together and then we can look at the total emissions from the economy over time. Next slide, please. Yeah.

So what I have here is a table which is showing the assumptions for the different scenarios that we use in PATHWAYS. And so we've already talked a bit about what the scenario philosophy is here, so I won't spend too much time on that. But just to kind of walk you through what the table is showing here. So the three main columns here are the three scenarios and then the different rows are the different categories of assumptions. And then these assumptions are color categorized by the large scale category. So you can see that the Res common transportation is categorized together because those energy demands are all provided by the CEC's modeling. And then for industry and agriculture, which includes also petroleum refining, the energy demands there are provided by PATHWAYS.

And then the other thing that pathways adds is assumptions on electric generation, low carbon fuels and non-combustion emissions. So I won't talk through all of the specific scenario assumptions here, but just at a high level to kind of highlight the most important things here. The Reference Scenario in terms of the assumptions we add in pathways is aligned with currently implemented policies on all fronts. So a couple of highlights here: that includes the 38 MMT by the 2030 GHG target that has been adopted by the CPUC IRP, we have the Low Carbon Fuel Standard for 2030, or through 2030, which has been adopted by CARB. And then we also have some existing CARB regulations on refrigerants and manure.

And then so the main thing then that is different about the Policy/Compliance Scenario, which is the second column here, everything on the PATHWAYS side is mostly the same except we have further reductions in non-combustion emissions. So we're compliant here with SB 1383, which has a 40% production goal for methane and HOC emissions by 2030.

Then lastly, for the Mitigation Scenario,

which is on the right here, the main change here is that there's a fair amount of industry decarbonization for which there's no existing policies other than cap and trade of course, which industry is under. Right. But so we have some pretty aspirational industry decarbonization in this scenario. So it's almost fully decarbonized by 2050 through a combination of carbon capture and storage, hydrogen, and electrification. No agriculture decarbonization though, which is actually consistent with existing PATHWAYS scenarios and what's included in the agriculture demands sector here is actually not any of the manure things or anything. It's mainly just energy demands for tractors and food processing and whatnot. So it's actually not very big.

The main other change here is that we have accelerated GHG reductions in the electric sector, so we hit 30 MMT by 2030 and then we have the SB 100 constraint after that, which is a 100% clean electricity target by 2045. Another thing that changes here is, is that we also have an increased use of advanced biofuels after 2030 and then continuing reductions in non-combustion

emissions after 2030. Next slide, please.

COMMISSIONER MONAHAN: Can I ask you just a quick question before you --

MR. MANTEGNA: Yeah, sure.

COMMISSIONER MONAHAN: So there's no -- so you're not -- what about like electric tractors? You know, now that is all the rage.

MR. MANTEGNA: Yeah.

COMMISSIONER MONAHAN: And the autonomous electric tractors --

MR. MANTEGNA: Totally.

COMMISSIONER MONAHAN: -- because there's a labor shortage.

MR. MANTEGNA: Yeah.

COMMISSIONER MONAHAN: And where does that fit in, if at all?

MR. MANTEGNA: Yeah. So that would definitely fit in here. We don't currently have any of those being used here.

COMMISSIONER MONAHAN: Mm-hmm.

MR. MANTEGNA: I will say it's not a huge energy demanding sector, so it wouldn't have a major impact on economy-wide emissions. But yes. So that is actually not considered here.

COMMISSIONER MONAHAN: Mm-hmm. Okay. So

there are future improvements to the modelling.

MR. MANTEGNA: Yeah. Exactly.

COMMISSIONER MONAHAN: All right.

MR. MANTEGNA: Yeah. So now I'm going to talk about our scenario overall GHG results for the Reference Scenario.

COMMISSIONER MONAHAN: Sorry.

MR. MANTEGNA: Yeah. Go ahead.

COMMISSIONER MONAHAN: This is my last one. I promise.

MR. MANTEGNA: No worries.

COMMISSIONER MONAHAN: So on the off-road ZEV question.

MR. MANTEGNA: Mm-hmm.

COMMISSIONER MONAHAN: Is there -- is there anything in your modeling that looks at off-road ZEVs? I mean --

MR. MANTEGNA: Mm-hmm.

COMMISSIONER MONAHAN: -- because again, it's we're seeing it happen. In fact, I was just at a mine, Rio Quinto, where the biggest electric like mover of earth you've ever seen.

MR. MANTEGNA: Yeah.

COMMISSIONER MONAHAN: Like it's happening.

MR. MANTEGNA: Yeah.

COMMISSIOENR MONAHAN: And I'm just wondering who's accounting for that.

MR. MANTEGNA: Yeah. So we do have actually some off-road demand that is actually included under the industry sector here.

COMMISSIONER MONAHAN: Oh. Okay.

MR. MANTEGNA: And so those are things that are not modeled by Quentin's modeling.

COMMISSIONER MONAHAN: Okay.

MR. MANTEGNA: And I believe that we do have a fair amount of decarbonization there through electricity, or through ZEVs.

COMMISSIONER MONAHAN: Great.

MR. MANTEGNA: Just not in Ag, basically. Yeah.

COMMISISONER MONAHAN: All right. Thanks. Thank you.

MR. GEE: Yeah. Commissioner Monahan, also the 2021 IEPR does include an off-road vehicle energy demand. That is not a part of this scenario. We didn't -- we weren't -- we weren't aware of any kinds of, you know, strong policies on the off-road sector that were going in that direction, so we didn't add

anything to it there.

COMMISSIONER MONAHAN: Yeah. And I think that's something we'll have to think about in the future.

MR. GEE: Yeah.

COMMISSIONER MONAHAN: Because it's part of the executive order.

MR. GEE: Yeah.

COMMISSIONER MONAHAN: In fact, it's extremely strong in the executive order.

MR. GEE: Yeah.

COMMISSIONER MONAHAN: So it's like uh-uh. Not just new but existing vehicles. So yeah.

MR. MANTEGNA: Yeah. I think it's 100% of existing by 2035.

COMMISSIONER MONAHAN: Yeah.

MR. MANTEGNA: That's pretty strong.

COMMISSIONER MONAHAN: It's very strong.

MR. MANTEGNA: Okay.

VICE CHAIR GUNDA: Again, I apologize. Just a quick question on the non-combustion emissions.

MR. MANTEGNA: Yeah.

VICE CHAIR GUNDA: So the 1383 --

MR. MANTEGNA: Mm-hmm.

VICE CHAIR GUNDA: So what are you -- so the -- it's the 75% of diversion, right? Of inorganics by 2030.

MR. MANTEGNA: Mm-hmm.

VICE CHAIR GUNDA: So are we assuming 40% of that. I mean are like, what is that?

MR. MANTEGNA: No. Yeah. So the 1383 goal is just on the emissions, right? And so the, the diversion of organics is a pretty separate question, right? Because that's mainly for like new landfills.

VICE CHAIR GUNDA: Okay.

MR. MANTEGNA: Right. So there's not a 75% GHG production mandate for landfills. Yeah. Mm-hmm.

Yeah. So now I'll talk a bit about this scenario results for the Reference Scenario. So what we're looking at in the bottom left here is the energy demands over time by fuel. The main thing to highlight here is that the electric loads are increasing over time, which you can see by this dark orange bar at the bottom. But and they increase about 50% by 2050. And the blue and the light blue bars, you can also see that

that there's a fair amount of renewable diesel blending over time and that's due to the LCFS. There's not a huge change in gasoline demand or natural gas demand over time.

And then the one other thing to highlight here is this hash bar up top, which you might be wondering about. And what this is, is the jet fuel demand for flights that are flying in and out of California. So the jet fuel demand for these flights is actually not included in the CARB GHG inventory. So historically it has never been included in the PATHWAYS model because it's aligned with the GHG inventory. So we just show that here for a reference.

And so moving on to the impacts on emissions, which is the bottom right here. What we see is that the emissions overall are declining over time, but we definitely don't hit the 40% by 2030 GHG goal and that is indicated by the top dotted line there. Next slide, please. Yeah.

So now a bit about the results of the High Electrification Policy/Compliance Scenario. And this is possibly, I would say, the most interesting and important scenario because it's

showing the impact of expected new policies. Right. So what we're seeing here in the energy demands on the bottom left is a pretty significant increase in electric loads by 2050, with loads almost doubling to about two extra joules by 2050. And you can also see a fair amount of renewable diesel blending here in the light blue bar, and this is once again due to the LCFS.

The main notable thing also here on the bottom left is the pretty significant decline in gasoline demand. So it's cut almost, I would say about 80% by 2050. The natural gas demands are decreasing over time a fair bit too. This is mainly due to fuel substitution, but there's still a fair amount remaining and that's mainly due to natural gas demands in this industry. And so what we see in terms of emissions here on the bottom right, and this is a pretty significant finding I would say, is that even with all of these expected new policies, and the 100% sales of ZEVs by 2035, and the State Implementation Plan for 2030, we still don't hit our 2030 GHG goal. So this is highlighting a pretty significant gap there. Yeah. So then we'll,

we'll see on the next slide is what is then required to, to close that gap.

So yeah, we're now looking at the High Electrification Mitigation Scenario. And once again, the main thing that's different here is there's a lot more industry decarbonization here. And so because of that, you can see on the bottom right graph here that we do actually hit our 2030 goal. And so I can -- I can tell you a bit about what exactly is causing us to get there. The main thing is the industry decarbonization. So there's a fair amount of GCFs on petroleum refining by 2030 and there's also a fair amount of industry hydrogen and electrification. And then also that electric sector GHG target is lower too. So the combination of all of those things does get us to our GHG goal.

One other notable thing here is you see that even with all of these aggressive assumptions, we still don't hit our 2050 goal, which is the 80% below 1990 levels. And the main reason for that, I would say, is that the electric power emissions are still pretty big, which I will talk about in a couple of slides here.

And one other thing you might be wondering about, right, is our Carbon Neutral Goal for 2045 and why that isn't on here. So the Carbon Neutral Goal is not strictly a zero direct emissions goal, right? It assumes that there can still be some remaining emissions and that those can be offset with negative emissions. So that's not shown here, but it is important to consider. Next slide, please. Yeah.

So here I just have a summary of the three scenarios in terms of emissions. And once again you can see that the Policy/Compliance Scenario, which is in the middle, does not hit our 2030 GHG goal. And then the Mitigation Scenario, which is on the right does. Next slide, please.

So just as a bit of context here. This High Electrification Mitigation Scenario, even with all of those inputs from the CEC's modeling for Res common transportation is actually pretty similar to past High Electrification Scenarios that we've modeled in PATHWAYS. The main difference I would say is if you look at this light blue bar, which is the electric power emissions, the current scenario is aligned with

SB 100, which actually does have a fair amount of remaining emissions in the electric sector, which I'll talk about on the next slide here. Whereas in past PATHWAYS scenarios, we've generally assumed a pretty deep reductions in the electric sector. So that's -- that I would say, is the main difference. And then the other thing, of course that's different is that we haven't modeled any jet fuel demand for out-of-state flights in the past. So. You can go ahead to the next slide, please.

Yeah so as promised, I also have a bit of an explanation for why the electric power emissions are so high here through 2050, despite that SB 100 constraint for 100% clean energy. Right. So there's two main reasons here that this is happening. So if you look at the blue bars here on the bottom of the dark blue and the light blue bar is showing that. So the total load that generators see, right? So that is partially made up of the retail sales and the state loads and actual loads on the demand side. But there's also a piece of that that that load, that's the transmission and distribution losses. And so SB 100 only applies to the retail sales in

state loads. It does not apply to transmission and distribution losses. And so because the accounting is done on an annual basis what that -- what that means is there's actually a fair bit of room for gas generation still to cover those -- that extra load.

And then the second thing here, which is actually also a pretty big factor as these green bars on the bottom right, once again here. And is that so clean energy that is exported actually still counts towards SB 100. And the interesting thing is that every megawatt hour of clean energy that is exported, actually makes one more megawatt hour of room for gas generation in the state. And this is actually consistent with RPFs accounting to like exported clean energy still counts. And so the sum of these two things is, is that under the current interpretation of SB 100, there's actually still a fair amount of room for gas generation. And that's why the emissions are so high there.

Any questions here?

VICE CHAIR GUNDA: Yeah. Thank you. I mean, this is super interesting slide here. So I was really aware of the TND losses and the

roughly the 93% of the electricity coming from kind of the SB 100 goals are being covered there, 93%. So just want to understand this a little bit more on the -- on the export. So are we assuming the imports coming into California broadly not zero-carbon.

MR. MANTEGNA: Yes. So most of our inputs are unspecified imports, which are assumed to be mainly gas. And there's also some specified imports too that are mainly north west hydro. But yeah, they're mainly assumed to be not zero-carbon.

VICE CHAIR GUNDA: And how are, I mean again, this this is a flag for us to continue thinking about.

MR. MANTEGNA: Mm-hmm.

VICE CHAIR GUNDA: How are we trying to take the WEC and decarbonization strategies into --

MR. MANTEGNA: Yeah.

VICE CHAIR GUNDA: -- into our thinking. Right. Like what's, what's the plan there.

MR. MANTEGNA: Yeah. So a RESOLVE, which is a WEC wide model is where these numbers are coming from. Right. And so actually that's why

we see this behaviored here, here in terms of the exports, right. Is what the model actually does is it says, oh look it's cheaper to just produce a bunch of clean energy in California and export it. Right. To meet that SB 100 goal. We do not have any GHG or RPS goals from our neighbors considered in this modeling here. So that would be I think one thing to possibly talk about in the future, right. Because yeah. So this only really happens if you have like just the California goal and no one else does. Yeah, right.

VICE CHAIR GUNDA: So it's basically California goal plus kind of status quo of generation concerning the WEC.

MR. MANTEGNA: Yeah. Exactly.

VICE CHAIR GUNDA: So if we kind of take into account Washington goals or Oregon goals --

MR. MANTEGNA: Mm-hmm.

VICE CHAIR GUNDA: -- this I mean, this could potentially come down significantly.

MR. MANTEGNA: Yeah.

VICE CHAIR GUNDA: Right.

MR. MANTEGNA: Definitely. Yeah.

VICE CHAIR GUNDA: Thank you. Very

helpful.

COMMISSIONER MONAHAN: Can I ask a question of Vice Chair Gunda, and maybe you Gabe. How does this align with our modeling for SB 100? The amount from TND losses and from the clean energy exports.

VICE CHAIR GUNDA: E3 will, I mean Gabe will help because on the -- much of our modeling was done through E3. But for the interpretation part of the TND losses, that's kind of how we did it. So the SB 100 called for only the retail sales. So the joint agency agreement is to roughly kind of account for 93% of the total electricity consumption to come from zero carbon, so the rest was non zero carbon. So in the SB 100 analysis we did some scenarios where we looked at even that 96% or 7% decarbonized.

The import assumptions were similar. But I think, Gabe, I would like you to kind of comment on this. These assumptions were similar in the -- in the SB 100. But you know, I'm just kind of thinking through of what are the updates done for the Scoping Plan since the SB 100. So that's what I do not know. But this was very consistent.

MR. MANTEGNA: Yeah. So this is actually the exactly the same interpretation of everything in terms of the retail sales and the exports as in SB 100 report. And the SB 100 report also had about 24 MMT of gas generation still there and it's only higher here because of the higher loads and yeah. So the only updates that have been made here, I would say, are really resource costs and planned resources and other minor things. But other than that, I would say it's about the same, you know.

COMMISSIONER MCALLISTER: I guess so just deepening that a little bit. I mean, so yeah, I mean, this does -- so I followed the explanation so far on this being consistent with the overall SB 100 work in the past. But it sounds like you're arguing that there there's kind of an incentive for active export of clean energy and active import of not, of undefined, that could endanger this pathway or.

MR. MANTEGNA: Yeah. And so that's only an incentive that's really seen by the RESOLVE model, right. It's like when it sees that constraint, it just seems that it's cheaper to meet that clean energy constraint by just

building a bunch in California and exporting it. Right. So, yes, so there's an incentive because it's a WEC wide model and it sees that.

COMMISSIONER MCALLISTER: Okay. Okay.

MR. MANTEGNA: Yeah.

COMMISSIONER MCALLISTER: Okay. Okay. Got it. All right. Thanks.

MR. MANTEGNA: Mm-hmm.

VICE CHAIR GUNDA: But Commissioner McAllister, I think to that point, right, like the broader regional kind of coordination, I think to the extent that if we were to reflect the regional clean energy goals, even though that that might exist in the in the market space, the opportunity for that would lessen significantly.

COMMISSIONER MCALLISTER: Yeah. Right.

MR. MANTEGNA: There would probably still be some.

And then also the treatment of imports also would have to be changed I think. Right. Because currently it's mainly unspecified imports. It's like what everything is counted as. Right. Yeah.

COMMISSIONER MCALLISTER: As we coordinate more across states, we're going to

have less and less unspecified and more contracts --

MR. MANTEGNA: Yeah.

COMMISSIONER MCALLISTER: -- that we can trace back to the actual electrons. Right.

MR. MANTEGNA: Exactly.

COMMISSIONER MCALLISTER: So that sort of minimizes the -- it makes the accounting clearer and minimize that definite activity.

MR. MANTEGNA: Right?

COMMISSIONER MCALLISTER: So yeah, so that seems like that's where we need to go. And as states adopt more stringent goals, even the unspecified --

MR. MANTEGNA: Mm-hmm.

COMMISSIONER MCALLISTER: -- may actually get better, right?

MR. MANTEGNA: Absolutely.

COMMISSIONER MCALLISTER: Okay. Yeah.

MR. MANTEGNA: So the main thing I think that would change here if you adopted like more of a WEC wide GHG RPS policy is that there would be less of an 00 of an opportunity for that arbitrage. Right. So if you're building a bunch of solar and storage in Arizona and in Washington

or whatever as part of their goals, right, then this arbitrage opportunity isn't as big.

VICE CHAIR GUNDA: I'm going to stop after this. But just want to one quick thing. This discussion is great. So given that most of our imports happen like late in the evening, right? Like after 7:00, right?

MR. MANTEGNA: Mm-hmm.

VICE CHAIR GUNDA: Like typically 7:00/8:00 is when you ramp up so that decarbonized electricity from the -- from the rest of the WEC would come broadly from hydro and wind.

MR. MANTEGNA: Mm hmm.

VICE CHAIR GUNDA: Right. So --

MR. MANTEGNA: That's right.

VICE CHAIR GUNDA: So basically, if we -- if we do not have more wind growth in the -- in the broader WEC --

MR. MANTEGNA: Mm-hmm.

VICE CHAIR GUNDA: -- then that would be a hard thing to come down.

MR. MANTEGNA: Yeah.

VICE CHAIR GUNDA: Right? So that’s --

MR. MANTEGNA: Yeah. Because presumably

everything, or everyone else isn't just going to have extra like batteries available. Right. And those evening hours because their load is also high. Right. So yeah, I would say it's mainly wind that would help.

And I still had a couple more slides if you want to go back to my slides. I'm almost done. Yeah, so next slide, please.

Yeah. So I just have a quick note on how the emission factors for fuels are changing over time here. I don't want to spend too much time here, but just proudly what we see here starting in the Reference Scenario on the bottom left is that we see that the emission factors for jet fuel, gasoline, and natural gas are staying about constant over time because the LCFS only applies to transportation. Right. And there's no --

(Muted)

MR. MANTEGNA: Can you hear me now? If someone in the chat could say if you can hear me now, that would be very helpful.

MS. RAITT: Sounds like they can. Go ahead, Gabe. Thanks so much.

MR. MANTEGNA: They can. Okay, great. Perfect. Okay. Yeah. So just a bit on the key

takeaways here.

Once again, the Policy/Compliance Scenario is showing that even with expected new policies, we're still likely to fall short of our 2030 GHG goal. And then the Mitigation Scenario then shows the level of effort that would be necessary to meet our 2030 goals.

Yeah. So that's all I had and I'll turn it over for questions now. Thank you, everyone.

VICE CHAIR GUNDA: Yeah. Gabe, thank you. And I just I just want to make a quick comment on the overarching kind of the content today. You know, just incredibly grateful to the CEC staff for helping pull this together. And Gabe, thanks for your contribution as well. I think this is an extremely important conversation. The energy, like the Demand Scenarios, both from long term electricity planning, the planning on the gas system, but also some important discussions on reliability. So I just wanted to start with just thanking the amount of work that that has taken place behind the scenes to develop a solid framework and develop the collaboration between our analytical products, E3's analytical products, and bringing

that all together. So really kudos to the entire team. And I want to call out Mike Jaske for his work and Anitha for your work, both of you, for really driving the framing of this conversation.

So my kind of recommendations for the for the staff, for our team is kind of thinking through as we talk about sector by sector that CEC's analytical products are contributing to think about overall sector impacts by fuel type as kind of summary slides. As we go through this, I think it'll be really helpful. Also thinking through as it pertains to reliability and supply, let's kind of have some internal meetings on how best to structure some of those visuals, right. So for example, based on where we are in terms of electricity procurement versus what the growth is and kind of constantly thinking through what analytical products are helping us to have, and just going to put some light on the needs on an ongoing basis and ensuring that we have that. That's one element.

We haven't as much talked about the gas side of the scenarios today, at least the summary of the gas. I believe there was some work on that. Right. Anitha, could you confirm.

MS. REDNAM: When you say gas, Commissioner, do you mean the natural gas?

VICE CHAIR GUNDA: Yeah.

MS. REDNAM: So we do have natural gas in Gabe's appendix slides. The slide that you asked is actually there. We have biofuels by sector.

VICE CHAIR GUNDA: Okay.

MS. REDNAM: So all the fuels are listed that we, through a combination of both CEC work and PATHWAYS model.

VICE CHAIR GUNDA: Great. You said that's in the appendix.

MS. REDNAM: Yep, Vice Chair. Yeah. We added them in the appendix.

VICE CHAIR GUNDA: Right. I think it would be good for the broader public to know that, so that'll be helpful for their comments. A lot of parties would be interested in that.

And just kind of thinking through, I think, the interactive effects between the hydrogen production versus, and then the overall demand. How do we capture those? And one of the things that Commissioner McAlister mentioned, at least the way I understood, is the market transformation that could happen in terms of

these large investments we are getting. So overall, you know, great work and I would just like to think about additional visual products to make this more accessible as we move forward. So I don't have any questions but you know, just thanks.

MS. REDNAM: I just wanted to add, Commissioner, that the hydrogen is produced through off grid electrolysis. I remember you asked us in our last discussion on this, so I have an answer for you on that. So the load from this is not included in the consumption. The electric load numbers, it's not included as of now.

VICE CHAIR GUNDA: So it's like broadly off grid is what the thinking is right now.

MS. REDNAM: Yeah.

COMMISSIONER MONAHAN: It would be really helpful to have a slide at the end with all the energy from -- that is being used. Like how much is hydrogen? How much is whatever is sort of left in the fossil world? I think it would just be helpful to kind of for a framework for all of us.

MS. REDNAM: Right.

COMMISSIONER MONAHAN: Something I heard recently from a stakeholder is this idea that actually we always thought hydrogen investments would be driven by transportation and that it would, you know, be basically the price of oil is so high that allows you to have more expensive fuels in the mix. But now that grid storage is such a valuable resource, actually, you're competing against grid storage on the -- on the electricity side. So it could be that hydrogen investments are actually driven more by the power sector need for reliability than the transportation need in the near term. And transportation could actually benefit from the investments that the power sector will make because as we're seeing with LADWP, there's just more, you know, there's an incentive for hydrogen to be a grid storage device. So I'm curious if Gabe or anybody has a reaction to that.

MR. MANTEGNA: Yeah, absolutely. So in our Mitigation Scenario, we do show a pretty big role for hydrogen in industry, too, although the difficult thing with that is that there's not as much of a near-term policy pathway for that. Right. Like it's the sectors are under cap and

trade, right. So that it would have to -- the prices would have to get pretty high before that would be actually incentivized.

As far as Electric Generation goes, the main investments that I'm aware of that are being made are by LA, right, because they have their 100% by 2030 target. I'm not aware of hydrogen being picked as a -- as a resource in the UCP IRP yet. So I'm not sure if there is that big of a role in terms of like a state wide perspective. But I do think LA is definitely a pretty interesting first mover there. Yeah.

So but as far as market size goes, yeah, I think there's definitely some potential from LA and then some from a transportation too, but the relative size I'm not sure, but yeah. Thank you.

COMMISSIONER MCALLISTER: I mean, it's interesting to think about whether price is actually going to be the forming, you know, in SB 100 and RESOLVE, you know it's sort of price is, you know, pretty much controls what resource gets picked. Right. But we may. That may not, you know, be where things end up in that last 10%. Right. I mean, we might have to be much more proactive than just having price. And some of

the analyses that I've seen show that price at that last little bit, the actual price of that clean, firm power actually may not matter all that much. I mean, obviously, you don't want it to be stratospheric, but it may not actually influence the sort of, you know, the price the consumer sees --

MR. MANTEGNA: Yeah.

COMMISSIONER MCALLISTER: -- as much as we kind of maybe assume. And I guess I'd like to get your you know, sounds like Quentin's thought about this as well. But, you know, what's your kind of view on that?

MR. MANTEGNA: Absolutely. So once you get to a pretty deep electric sector, a GHG or RPS constraint, right, then I think that you definitely see some clean, firm stuff getting picked. Right. And that's kind of that last like 5 to 10%. Right. So could be hydrogen or CCS or SMRs, right. I think we generally see hydrogen as the cheapest of those options. So yeah, I think that could definitely get picked and it probably wouldn't have a huge impact on overall costs. The marginal like dollars per ton GHG cost is probably pretty high, right. But the

impact to ratepayers I don't think would be huge. But this is definitely an area that I think would require future study by the CPUC, right. As far as like what could a zero carbon grid look like? Like what would be the rate payer impacts? Like does it make more sense to do that or other things? Right. So yeah, it's an important area for sure.

COMMISSIONER MCALLISTER: Yeah. So I don't really have any additional questions, but I just wanted to just amplify what Vice Chair Gunda said in terms of just really excited to have this kicked off. And it's a super creative time, I mean, in this realm of, you know, trying to figure out what's going to happen and what should happen and you know, where things are going, it's just a really heady time to be to be having these conversations. And, you know, there's a lot of urgency to figure this out. So I'm really glad we've got this, the team that we have on this and including leadership you know, from Vice Chair Gunda, and I think, you know, all of us in our sectors are very interested in this.

And also just wanted to point out, I think this is happening, but just point out that

how important it is to share resources across agencies. You know, the CARB is I mean, in a way you're, you know, E3 is the connective tissue on some of this stuff, but it's nice to be in and continually kind of be getting more or less on the same page. I mean we're not always going to have the same perspectives on these things, but as agencies, you know, I think it's our obligation to compare notes and really see where if we're getting different answers, when we're getting different answers, why? And kind of that's going to reflect back on the policy choices that we're making in really substantive ways. And so I think that's super important to share resources and intel and, you know, on the on the building side and on the power sector side, I mean, where the market's going, you know, we all need to kind of compare market awareness and, you know, understand market developments like that, power sector role of hydrogen. I mean, I think that's a huge question. You know, it sort of highlights, you know, the sort of intersectoral nature of this.

And one of the things that I think is new and different today versus any kind of

forecasting in the past is -- are these bridges across different energy carriers. You know, like we're increasingly not talking about energy sources as much as we are energy carriers. And so, you know, they're increasingly fungible and that creates complexity, but also a lot of solutions. So anyway, that's super interesting and, you know, really excited to, you know, take part in this discussion going forward. [indiscernible] interesting.

MR. JASKE: This is Mike Jaske here. Let me just respond to that point that you made, Commissioner McAllister. And that is, as I tried to say early on in my sort of framing of what this was all about this afternoon, our project is, in some respects, picked out the easy parts of all of this analysis to start with. And you know we had tools that could roughly address some of the traditional issues. You know, energy efficiency programs and even fuel substitution programs on the end user side. There are all of these ramifications for different supply side industries. Some regulated, not regulated -- and some not regulated that you know are -- have huge ramifications in some cases at the scale, but

also huge from the perspective of individual industries, you know. Just a little sleeper one is, you know there's a fair amount of LPG being used in rural parts of the state.

You know, as we eventually try to deal with LPG, what are we going to do with, you know, the hundreds or thousand LPG distributors that exist out there in the world? You know, there's no -- there's no rate making process that's going to protect them, you know, and sort of make their investment whole. You know, so are they all going to disappear in some, you know, inappropriately mass fashion because of some unforeseen aspect of some regulation or requirement, leaving a bunch of customers kind of stranded? Many, you know if not primary, at least secondary reliability kinds of things to think about as niche fuels and special applications kind of go away. So.

VICE CHAIR GUNDA: Yeah. Thanks, Mike. So one thing I just wanted to take from what Commissioner Monahan suggested; it would be really -- I mean even though I don't completely enjoy skanky diagrams, but it might be something we want to have as one of the summaries. Just

kind of a I really like this notion from Commissioner McAllister too. I think the more and more we're not really talking about sources and it's more the carriers, I think being able to stitch that entirety into a slide on what's happening and how it's all changing would be really helpful. Thank you.

Onto Heidi now, right?

MS. JAVANBAKHT: All right. So we're now moving into the Q&A for the Demand Scenarios portion of the workshop. We've got a few questions that were asked online. So I'm going to start with there's one similar question asked by two different people. Joanna and Yen both asked about Slide 8 in Quentin's presentation. There's a difference between the reference case and the Policy/Compliance Scenario, where the Policy/Compliance Scenario is lower than the reference case between present and 2025. Quentin, can you speak to why that occurs?

MR. GEE: Yeah. yeah. If we could move to Slide 8, I can actually discuss that a little bit. But yeah, basically the Policy/Compliance case is a sort of a at least especially in the case of the light-duty zero-emission vehicles,

but this would also theoretically happen in the case of MDHD as well. But the Policy/Compliance case simply says, you know what if we meet what the regulations in place say at least up to 2035. And the regulations in place currently are the regulation in place on light-duty ZEVS that is impactful here is Advanced Clean Cars I, which has lower ZEV requirements than what the market currently is, you know, has or what the stock is out there based on the current market conditions out there.

So as of today, what is required under ACC I is in fact lower than what is on the road as we speak. So basically, we do have this sort of undercutting of the Reference, or excuse me, the ACC I goes under what the Reference Scenario is because that regulation, I think in the early years when it came out, you know, wasn't expecting the kinds of rapid declines that we have seen in vehicle prices and market penetration of ZEV companies. So yeah, the regulation just isn't as strong there, but we just sort of put in the regulation in place. So it actually does go lower than the Reference.

At around 2027 you can see, however,

that, and that's when Advance Clean Cars II begins to kick in. At that point in time, we do see that that the regulation is going to go above what our Reference case says for the market as well. And, you know, there's a bit of an interplay, obviously, between the market and the regulations. So it's hard to, you know, evaluate the forecast or that Reference case too much. But, yeah, the current -- those first few years are just kind of just the result of lower regulations than the market could bear.

MS. JAVANBAKHT: Thanks, Quentin. The next two questions are also for you.

MR. GEE: Okay.

MS. JAVANBAKHT: Can we look at the slide after that one, Raquel? With the MDHD population. So this question comes from Janet, who asks why does the total population for MDHD appear to be smaller under the Policy/Compliance and Mitigation Scenarios?

MR. GEE : Great. Excellent question. Good eye also. These three charts, hard to fit them all on the one slide, but we did it and you, good attention there.

So this is a peculiar, I wouldn't call it

a peculiarity, this is a feature of the model, the medium- and heavy-duty model. Basically, the vehicles that are adopted are based on the shipping, the amount of freight that needs to occur, at least for the for the freight vehicles here. And basically what happens is newer vehicles are actually able to ship or, you know, they're not being repaired as much. They're not you know, you know, if you've got ten trucks in your fleet and it's kind of like, oh, we got to make a last minute delivery, you're not going to send out the one that could break down. You're going to send out the newer one. So basically the newer vehicles actually ship more. So if there's more new vehicles that say as a result of a increase of ZEV penetration then or excuse me, as a result of say, say the retirements and other things like that, you actually don't have as much of a dramatic need for as many trucks to do that. That's why the truck stock, while it's a meaningful indicator, it does have some limitations there. And the energy metric might be more useful on that. But yeah, because the trucks are newer or you have these retirements, you don't need as many trucks to ship around the

same amount of goods because the amount of goods on each of these scenarios are the exact same.

MS. JAVANBAKHT: And Quentin, there's a second part to that question about BEVs perhaps not being a 1 to 1 replacement for diesel trucks.

MR. GEE: What's the question say?

MS. JAVANBAKHT: Oh. I lost it. Hang on a second.

MR. GEE: Oh.

MS. JAVANBAKHT: Most believe that the transition to ZEVs for heavy-duty vehicles will require a more than 1-to-1 replacement, suggesting that the total truck population will increase as more ZEVs are mandated.

MR. GEE: Yeah, that's certain, that's something that I don't think the model captures. That's to some extent arguably a good point. In some ways you might say, you know, you can't do you know, you can't drive necessarily a class 8, you know, long haul as many miles with diesel -- with battery electric than you could with diesel. But the model does have increased penetration from class 8 fuel cell electric vehicles, which do have similar range potential to diesel. But yeah, that's a reasonable point

in some ways. At the same time, you know, the uptime for the battery electric vehicles is expected to be higher in some cases. So they might actually be more reliable, or more likely to take on some of that freight need. So it's a little tricky and challenging there.

But that's a good point and something that I think we, you know, would like to hear from any stakeholders that have some information on that front. And it's something we could consider employing or considering in the model.

MS. JAVANBAKHT: Thanks, Quentin. Okay. One last question on transportation.

Do these numbers include tourism. For example, rental car electrification and visitors driving their vehicles into the state and charging on the grid?

MR. GEE: Okay. Yeah, that might be the slide 11, maybe Raquel. Maybe that could be useful. So here we are looking at the energy demand. We do, so in our model we do include four different major types of vehicle choices that are made. We have personal vehicles, commercial vehicles, government vehicles and rental vehicles. So we do include, say, the

rental market there. We also do cross validate energy consumption, particularly as, at least as of now, the big metric is gasoline consumption, but the gasoline consumption, we make sure that that matches as well with the -- so we check like how much gasoline was purchased in the state and we make sure that aligns with our model. So that's part of the validation of the model. So any potential, let's say like a bunch of people from Arizona drive over and are fueling up that would be roughly captured there as well. Yeah.

It's hard it's hard to get any more clarity beyond that. Like who -- how many Washington license plates are fueling up in our state. It's hard to know that. But we do cross validate and we make sure that the model aligns with the total vehicle, total gasoline and other liquid fuels that are sold in the state.

MS. JAVANBAKHT: That's it for the questions online.

MS. RAITT: Thank you, Heidi. And thank you, Quentin. Oh, we had just one more come up.

MS. JAVANBAKHT: Oh did you? I'm sorry. Okay. Okay. So one last question. Was electric consumption for hydrogen, electrolysis for

transportation included in this modeling?

MR. GEE: Unfortunately, no. So that is a limitation. Yeah, we don't. So when we look at the electricity demand, we're looking at electricity, you know, on the grid flowing into a vehicle. For electrolysis, that is something that we could look at exploring, but we currently don't do that.

MS. JAVANBAKHT: Okay. No other questions.

MS. RAITT: Great. Thank you, Heidi. Thank you, Quentin. And thank you to all the presenters. I know there's a lot of late nights and long days to get here.

So Commissioners, if you – it sounds like we're able to take a ten minute break. And we'll be back at 3:40. How about it will be a 12 minute break, just to be rounding.

VICE CHAIR GUNDA: All right. We'll come back at 3:40 you said?

MS. RAITT: 3:40, yeah. We'll put a slide up with the time.

VICE CHAIR GUNDA: Okay. Thank you.

MS. RAITT: Thanks.

(Off the record at 3:28 p.m.)

(On the record at 3:47 p.m.)

MS. RAITT: Welcome back. We have our final presenter, Mike Jaske, again. Talk about the inter-agency effort. So go ahead, Mike. Thanks for being -- hanging in here.

MR. JASKE: First slide. Good afternoon. For the record, I'm Mike Jaske with the Energy Assessments Division of the CEC staff. Today, I'm speaking as a representative of an interagency project. In this presentation, I'll talk really about, well, about a separate demand scenario project from that presented earlier. The two are related analytically but have different emphases and purposes. This presentation really has four broad elements: the purpose of the project and interagency coordination; the phases of the demand analysis; a high-level overview of annual electric energy, summer and winter peak load, and some hourly load pattern insights; and then the timeline of the remaining steps of this project. Slide 2.

So both the PUC and the ISO have referred to this project in formal decisions or study plan documents; the PUC in the February IRP Decision, and the ISO in the Final Study Plan for the

current 2022-23 TPP process. Up to this point, this high electrification project hasn't been presented in an IEPR proceeding. So as I very briefly alluded to in my opening presentation this afternoon, the -- there was considerable discussion about a High Electrification Scenario; what that might be, what it would be used for, when it could be done, beginning in last summer and continuing into the fall.

Eventually, the lead staff of the energy agencies agreed to develop an assessment of the transmission system impacts of a scenario with higher electrification than was included in what was then expected to be the outcome of the 2021 IEPR Adopted Demand Forecast. And the three agencies, the CPUC and ISO each had, of course, particular roles to play in this overall project. The Energy Commission to develop demand projections. The PUC to analyze those demand projections in their resource planning process and consider it in their distribution infrastructure assessment process and the ISO to take the Demand Scenario projections and the PUC results as inputs into a sensitivity study of transmission impacts. So this study would inform

sort of an initial view of higher electrification and the generation consequences in the sort of conventional transmission system planning time horizon.

So just for clarification purposes, let me reemphasize the first bullet. We're -- in this project, we're developing an assessment of a demand scenario that has higher levels of electrification than in the adopted 2021 IEPR Demand Forecast. So relative to that forecast, this scenario has High Electrification. And both the PUC and the ISO in these decisions and study plans have referred to it in that context when they normally would use the IEPR Adopted Forecast for their analyses. So that's why it's called High Electrification. Next slide.

I think I pretty much summarized the last three bullets here on the previous slide but let me spend a minute talking about an Inter-Agency Working Group. So we devised, or we decided there was a need to have, a working group that would oversee, you know, the development of this demand scenario and presumably its use in the PUC and ISO follow-on efforts. And that is sort of the new element here that hadn't existed

heretofore. Next slide.

So we formed that group in November of last year, had technical leads of all three agencies. It met multiple times beginning in December of last year and January through current days this year. To clarify the nature of the project, discuss, you know, which agency was going to carry out what tasks, and to design a consensus scenario specification. And that working group presented its proposed design to the broader joint agency group for approval back in mid- to late-February. CARB had some clarifying questions, which took a couple of weeks to resolve, and we settled on the overall design in late February. Next slide.

So this is the same format that you saw previously for the Energy Commission's own Demand Scenarios project. We're using it to convey, again, the assumptions for this particular scenario. And this laid out in virtually the same manner a baseline forecast, namely the Mid-Mid Residential Commercial Forecast. Some AAEE adjustments to that. In this case, Mid-High Scenario 4 and Mid-Mid Scenario 3 for gas. That programmatic part of fuel substitution is Mid-Mid

Plus Scenario 4. And then the -- what we have written as speculative but maybe uncertain is a better word, the incorporation of elements of CARB's 2022 SIP Plan. And then in transportation, again, a baseline forecast, the Mid-Mid Adopted Transportation Forecast modified by the elements included in the state's SIP, namely Clean Cars II and Advanced Clean Fleets.

What is different. So far, these look a lot like the Policy/Compliance case, which is a correct observation. It's in the last row but there are some differences, and that's in the industrial oil and gas, AG, petroleum, refining, TCU, all of those sectors that in the other scenario project were done with an adjusted version of PATHWAYS. They have different assumptions which are essentially one ratchet tighter in terms of AAEE and AAFS than the Mid-Mid Adopted Demand Forecast. Next slide.

So our ability to do this scenario obviously benefited from design and to a considerable extent the quantification of the Internal Energy Commission project. If we hadn't been that far along in our analytic efforts, I don't know that we would have been able to

accomplish this Inter-Agency project on the timeline that we have.

Because we are only going out, well, so there are several reasons why we are using Energy Commission demand forecasting models and load modifier assessment tools rather than Adjusted-PATHWAYS. So first is the time horizon of interest was only out to 2035. And I'm not myself right at this moment, completely clear which of those years out to 2035 the PUC and ISO are going to examine. But they have a product that goes out as far as 2035 and that was within the scope of the Energy Commission's forecasting models. We didn't need the capabilities of Adjusted-PATHWAYS to cover all of the myriad of alternative fuels, many of which are unique to transportation or industry. And we didn't need GHG consequences, so there wasn't a need to stick with Adjusted-PATHWAYS.

And we also wanted and needed greater electricity demand detail than can be developed using Adjusted-PATHWAYS. For example, creating hourly electric generation load or computing results at the level of major utilities attack areas. That wasn't feasible with PATHWAYS. So

the platform for some of the minor sectors was shifted from Adjusted-PATHWAYS to demand forecasting models. Next slide.

So the point of this slide is to indicate that we broke this project down into three phases, mainly to facilitate development of interagency consensus. So we, through the working group process, first developed a proposed specification of a High Electrification Scenario. Once that was agreed to, Energy Commission staff used its forecasting models and load modifier tools to project annual energy out to 2035. We provided the result of that analysis to the working group and actually we talked about preliminary versions of it as part of the finalization of the scenario specification.

Once that was deemed acceptable or complete, we moved on to a review and consideration of alternative load profiles that are used to take that annual electric energy and convert it into hourly 8760 projections for the three IOU TAC areas.

And we -- and then the last of the phases is just about to start, which is to take this peak hour annual impacts for each of the TAC

areas and allocate these loads to load buses. And we do that using information comparable to what we have traditionally done in this load bus allocation step for energy efficiency, but in the 21 IEPR expanded it to programmatic AAFS and we'll now expand it one more ratchet to deal with the sort of SIP level building electrification consequences and to the increment of transportation. And that work will be undertaken over the course of the next five or six weeks and would be reviewed again at the Working Group level. Next slide.

So here's the first of the results that I'll show for a number of slides now. This is looking at the incremental effects of the load modifiers that were changed between the 2021 Mid-Mid Adopted Forecast and this High Electrification Scenario. So as you can see from the legend down below, these are the differences between the load modifier annual the electric energy of the High Electrification Working Group Scenario, less the corresponding IEPR Mid-Mid case.

So the darker blue line up near the top is the delta for light-duty EVs. The red line

down near the horizontal axis is the delta for medium-duty and heavy-duty EVs. The green line is the delta for energy efficiency in the working group assumption versus the IEPR Mid-Mid, and that's the one case in which the values are negative because as the framework slide showed, we're assuming AAEE 4, which has more savings than a AAEE Scenario 3 in the Mid-Mid Adopted IEPR.

The purple line is the delta for High Electrification AAFS, and what was in the IEPR, and it's practically near the, or on top of the horizontal axis, so there's hardly any difference there. And then finally, the brighter blue line is the delta of the High Electrification; more modeling of the SIP measures in the building sector, less the corresponding IEPR assumption. And since the IEPR assumption was zero, that is the actual total magnitude of those impacts. And then the dashed black line is the summation of all of those together, both positive in most cases and negative in the case of energy efficiency.

So as has been shown in some other depictions of the policy case of the Internal

Energy Commission project, the composite of these effects is actually a little bit of a load reduction out through about 2029 and then it matches up. Where it crosses the horizontal axis and then grows steadily thereafter. Next slide.

So this slide tries to put those incremental impacts in context. So the dashed black line is exactly the same numbers, but the scale is different than the previous slide. The dark blue line is the adopted forecast, practically a straight line, and the red line is the black dashed line added to the blue line. So it shows that in this scale they're practically on top of each other again until about 29, in which there's a departure and the high electrification case grows steadily thereafter. And that's about by eyeball, around a 15% increase relative to the Adopted Forecast in 2035. Next slide.

So what do we do with this annual electric energy? As I said, we conducted a load profile review process before we actually converted that annual electric energy into hourly loads. We first contracted with E3 to review our load profiles and compare it to what they have

used in various of their own studies. And we -- and concluded that there were no substantive issues that they could identify that you know, caused us to make a change.

We took another run at asking that question in the more narrow context of transportation load profiles by talking with each of the IOUs. And we were particularly concerned about how TOU rates might influence EV recharging. And there is an impact of a particular TOU rate assumption on EV recharging in the Energy Commission's Final Load profiles that are used to generate the system consequences of EV recharging. But a perceived weakness that we assume those TOU rates are unchanged out through time. And that seems like a not very logical assumption, but we didn't have a better one in the time horizon of the forecast development. Unfortunately, none of the IOUs seem to have any feel for that issue out beyond about 26 or 27. And so we ended up not making any changes, even though we think this is a clearly an important issue going forward.

We also talked about some other issues about EV forecasting in general with the IOUs and

identified, you know, various items that we can work on in future iterations of this kind of effort. Next slide. Slide 11, please.

So as everyone will realize if you think about it for a lot of induces residential sector appliances we already have broad penetration of the electric version compared to the gas version in the appliance stock out there. So we've had to know and use load profiles for ranges, and clothes dryers, and dishwashers, and water heaters, and all kinds of components. And so really in those instances, what we're doing is essentially scaling up with more annual energy, a known load profile.

But in the case of residential space heating with heat pumps, not nearly as well understood, and particularly the consequences of placing a lot of electric energy in two or three winter months, you know, is clearly going to affect winter electricity load patterns. But to what extent is really the question? In the AB 3232 process that was conducted over years 2020 and 2021 and documented in the report to the Legislature, in the high penetration scenarios, we found that winter loads in Northern

California, you know, could actually approach that of summer peak loads. That wasn't the case in Southern California since space heating requirements are simply much less lower in Southern California. But there's -- that was sort of a backdrop for concern about this whole winter space heating load issue.

And so our 8760 assessment for the three IOU TAC areas and therefore coverage of all of the ISOs is designed to further understand both summer peak and winter load assessments.

Just a point of context, perhaps, except for a few localized areas. California has been summer peaking for decades. In part, this is driven by our climate, by the advent of cheap central air conditioning starting in the 60s and 70s, and its progressive increase in saturation through time. But it also results from Energy Commission building standards that promoted the use of natural gas for space and water heating as a more energy efficient way of providing these services.

So we have an end use, fuel share mix at the present that's heavily skewed toward natural gas appliances compared to most areas of the

country. And we have a lot to learn, therefore, about winter load issues associated with electricity supply in what are presently gas space heating and water heating. So this assessment hopefully is going to lead to some further understanding above and beyond what we learned in AB 3232. Next slide.

So here are the seasonal peak load results at the ISO level. The top two lines are the summer peak. The blue line being the Adopted IEPR and the red line being the High Electrification case. And the very same pattern has showed up for annual electricity. It repeats itself here a little bit lower in the High Electrification case through about 2028, and then crosses over and then rises above steadily larger amounts through time.

The bottom two lines are the winter peak, which we hardly ever talk about a winter peak, but given what I was saying earlier, it seemed like an important thing to look for in the results and to show you what we have found. So the green line is the maximum over the months of December and January that is in the Adopted Demand Forecasts using the hourly output files.

The purple line is the same source of data, but for the High Electrification Scenario and here you can see there's less extent to which the High Electrification case is lower than the Adopted Forecast, crosses over maybe one or two years earlier and then grows well above the Adopted IEPR by time you get out to 2035. And the gap between winter and summer peak is narrowing in the High Electrification Scenario, whereas it's relatively constant in the Adopted Forecast.

So we are clearly seeing some seasonal shifts in patterns of load. I have looked at a more disaggregated level of reporting. And this is almost entirely coming from the residential sector, as you might guess, because in the fuel substitution part of buildings, residential sector is about four times bigger than the commercial sector. And so what happens with residential space and water heating really drives overall gas fuel substitution results as they convert into hourly loads. Next slide, please.

So this was an interesting result. And it will be something that I think the CPUC in IRP assessment using these results is going to need to address. So these two boxes depict pieces and

the total of the hourly load on the winter season peak day for the High Electrification Scenario. We're not comparing between High Electrification and Adopted 2021 IEPR Forecast in this case. It's just two different years within the High Electrification Scenario results. On the left is 2033 and on the right is 2035. So two years difference.

The peak hour on this winter peak day is at hour 22. That's later in the evening/night than in the Adopted Forecast, which is about hour 19, I believe. There's a secondary peak in the morning, but it's several thousand megawatts lower than the peak hour of hour 22. And that secondary peak is composed in 2023 heavily by kind of natural factors, but also that the red line, which is the electric vehicle across all classes, light-duty, and heavy-duty, and medium ramping up, presumably because vehicles are moved from overnight storage or use patterns to a morning use pattern and there's considerable ramping up in the morning hours.

And the green line is the composite of all of the influences on the residential commercial building sectors, both negative from

energy efficiency and positive from fuel substitution. And there's a modest increase moving from hours 4, 5, 6, toward hour 8. However, when you get to 2035, if you look at the blue line at the top for the moment, the peak has now shifted. It's shifted in day -- in month to January. It shifted in hour to the morning to 8 a.m. or 7 a.m.. The absolute magnitude in the nighttime hours doesn't seem to have changed very much. It's the very same pattern but it's that morning peak that has become accentuated. And why does that happen?

The red line being all of the EV recharging is the same shape just scaled up for the increase in annual electric energy. But the green line has a different shape. Clearly, the morning elements are higher than the change in the nighttime elements or the daytime elements. And this reflects residential space and water heating that is most focused in those early morning hours, as millions of people in our state get up, start turning on the lights, using appliances. And when those appliances are fueled by electricity, we have increased load in preferentially in those hours.

So interesting tidbits that come out of our hourly analysis that has now been handed off to the PUC and in their hands for analysis. Next slide.

So I'm going to speak just a little bit about the last phase of this whole effort and which is the allocation of load to transmission load buses. And for those who aren't familiar with that aspect of electricity planning, just let me give you a little overview of how this works.

The transmission system has evolved over time and there are areas where the transmission system is constrained in how much power it can provide to the load inside sort of a boundary of a composite of transmission elements. This is the genesis of the local resource adequacy requirements that utilities in all the other load serving entities have to address on an annual basis as part of the resource adequacy process.

The ISO and the utility study these local capacity areas using very complex engineering models that actually predict the flow of power on the grid from generating sources to loads, to demands. Hence they're called power flow models.

In every IEPR cycle, the Energy Commission, well since about 2013 or so anyway, the Energy Commission staff allocates the Adopted Demand Forecast to a set of load buses that are used in these power flow studies. And in this project, we're going to be adapting the existing tools that we have used to address the location of these incremental electric loads from this High Electrification Scenario.

We will be giving that to the ISO for its use in this part -- it's part of this overall infrastructure assessment effort, and we're going to get this underway, you know, starting next week now that we have this workshop over and deliver it by June 1st. Next slide.

So I mean, winding up here with just a little bit of a project timeline. Everything up through March of 22 is now history. So we began our discussions last summer. We agreed to conduct this effort. We formed the Working Group to figure out what the effort really was and bring clarity to who is going to do what by when. Developed the scenario, analyzed the results, converted into 8760 hourly impacts, and delivered that to the PUC last week.

So what is to be -- what is to come is for the PUC to assess this higher level of electric loads using some sort of light version of an IRP analysis, deliver a resource portfolio, tagging the incremental generating resources required to serve load reliably to the ISO by June 1st. And in parallel, as I said a moment ago, the Energy Commission staff will develop the load bus allocation to the ISO and ISO will take all of that as input into a Transmission Impact Sensitivity Study. And I've confirmed this last date with the ISO staff and they anticipate releasing the results of this in January of next year.

And with that I am finished and I'm ready for any questions.

VICE CHAIR GUNDA: And Heather and Tim, I just want to note that I have to jump off and Commissioner McAllister will help kind of close the discussion here.

Just, Mike, just thank you for all the work on this. I -- you've been kept -- you kept me briefed up on this a lot, so I don't have any other questions. But just for the public who are attending the workshop, but also fellow

Commissioners on just the impact of winter electrification. I think it's something that I just kind of caught my attention as we think through not just the winter peak load, but also the early hour peak as well as movement of the net peak time potentially to a later time.

All of them are system reliability issues and thanks for flagging them and hopefully we can bring them up in a future reliability proceeding and think through the implications and how to best plan for it.

But thanks again to the entire team for all the great work on this.

COMMISSIONER MCALLISTER: Yeah. Thanks a lot. Yep. Everybody's thumbs up. But thanks a lot, Mike and team. I mean, there's a big team behind you on this. And so I think it's really -- it's really great work. And I think, you know, the flip side of the challenges that Vice Chair Gunda just sort of implied, you know, on the reliability side, we also have some tools that we can hopefully use to massage some of these loads and encourage them, you know, particularly that morning peak. And as we successfully deploy more storage and better

storage and more diverse storage on the demand side, you know, potentially manage that evening peak kind of assertively or intentionally at least as well. So but really appreciate this work and, you know, and trying to just understand the implications of all the -- of all the new stuff that's going to happen on the electric grid.

So and also just given how long it takes to site and build new transmission, I mean it's already kind of upon us, you know. So even though the big impacts are sort of out at the 29 and beyond, that's not that far away. So really, I think the timing here is really excellent as well.

And again, really appreciate the cross-agency collaboration on this. Really I think makes sure that we get a product that's well vetted and grounded, you know, from all the different perspectives. So really appreciate that.

I don't have any particular questions, but really glad to see this progressing.

MR. JASKE: Thank you.

COMMISSIONER MONAHAN: And I'll just say,

you know, from a transportation perspective, that it's interesting to see the contribution that transportation makes to the load going forward. And as we think about the potential, especially for big ZEVs to provide energy back to the grid, I think there's a lot of interesting food for thought about how transportation could not just be part of the electricity usage, but actually part of the electricity generation at certain times of the day.

So it feeds back into our -- the work that Vice Chair Gunda is shepherding around DERs and how do we make the right investments from an R&D and transportation deployment perspective to be able to capitalize on that opportunity, which is, I think as yet ill defined?

COMMISSIONER MCALLISTER: Yeah, totally agree with that. And I also found it interesting that the, you know, in the out years in 35 you know, it was impact on the transportation -- the impact of transportation on that load growth was roughly double. Right Mike? I'm just eyeballing it, about double the buildings.

COMMISSIONER MONAHAN: Yeah. And then you go out to what Quentin was modeling to 2050

and you really see it.

COMMISSIONER MCALLISTER: And you really see it. Yeah, Exactly.

COMMISSIONER MONAHAN: I mean, I would be interesting to see what that translates to in terms of the percent of electricity.

COMMISSIONER MCALLISTER: Yeah.

COMMISSIONER MONAHAN: But it could be half or more.

COMMISSIONER MONAHAN: Yeah. Yeah. And, you know, that's quality batteries, right? If we can really make that happen, that's great resource to have out there on the distribution grid. You know, a lot of batteries that are standing at the ready. So. Yeah. Great.

All right. So no further questions I think.

I want to just really thank the staff. I mean, everyone today, really. Mike and Anitha, congratulations on kind of going public with some of your work. So that's great. And Ingrid and Quentin, thanks so much. I mean, just we really rely on you and you're so articulate on these issues. And Gabe, thanks for being with us as well. And Heidi, thanks for managing all the

proceedings, which are both virtual and in-person. So really appreciate that.

So I think I'll pass it back to Heather and Heidi to manage the public comment.

MS. JAVANBAKHT: All right. We've got three questions that came in online. The first, the question for Mike. What is the major driver or drivers in the winter months for electrification? Is it accelerated installation of heat pumps? And then as a follow-up, since the cost of gas is still lower than electricity, I was wondering if this scenario takes into consideration that the gas abatements, the gas abatement costs to change. That was a mouthful. Let me know if you need clarification on that, Mike.

MR. JASKE: I think on an annual basis, the highest residential sector change is water heaters, in terms of annual energy. But since the space heat is so concentrated in the winter months, It's what drives the winter peak more than water heating.

The other part of the question was our cost taken into account? Cost obviously is an important factor but should CARB's State

Implementation Plan control measures actually be adopted as part of the S IP and implemented on a statewide basis as we're assuming in this scenario. In effect, CARB has made the determination that the NOx reduction benefits exceed the cost implications, if any. And so it's a -- it's a ambient air quality attainment strategy that has been dictated essentially by CARB. And it's no longer a consumer decision. It may not even any longer be a utility cost effective, you know, cost effectiveness type decision.

MS. JAVANBAKHT: From HongYan, also for Mike. The Inter-Agency High Electrification Scenario assumes higher AAEE forecasts in addition to higher electrification forecasts. How do you view the relative uncertainties between them as the higher AAEE forecast will offset the higher electrification load growth, it is important for us to weigh in the different risks to avoid underestimating the overall load impact on the grid.

MR. JASKE: That's a good question. I'm not sure I have a good answer. We hear a lot of concerns about the negative, well the difficulty

of citing all the generation associated with higher electrification, perhaps not so much in this time horizon, but you know, further out into the 2045, 2050 period. And so mitigating that by pursuing cost effective electric energy efficiencies seems like a thing that the energy agencies are going to want to continue. Whether it's at this exact level or some other level, I guess I can't say. But we thought it was important to build that into the scenario simply because it does seem like a proper policy consideration that we wouldn't just continue with business as usual energy efficiency efforts.

MS. JAVANBAKHT: Okay. The next question is from Mark. Do your models allow for relatively sudden scaling of distributed batteries, solar, and smart microgrids sufficient to meet demand from both buildings and vehicles on each property, using conversion kits for medium- and heavy-duty vehicles and solar canopies with stationary batteries to power them, could pull this into late 2022 or throughout 2023.

I think it continues later in a different thread. The assumption is breakthroughs in

performance cost and longevity for the technologies.

MR. JASKE: No. We have not modeled any increment of rooftop solar or behind the meter batteries in this analysis than was contained in the 2021 IEPR forecast, which do grow through time, significantly in fact. But we're not modeling it in the sense of this person's question of, in effect, going to a non-grid oriented electricity system. It's just we're still forecasting and planning on a more, call it conventional basis.

MS. JAVANBAKHT: One from Shonika and one from Ben about DERs and where they fall within the scope of the Demand Forecast is one of the questions. And the other question is do any of the scenarios consider targeted deployment of DERs?

MR. JASKE: No. We do not consider. Let me try to answer both them at the same time. We do not, as I just said, include more rooftop PV or behind the meter storage or any other DERs for that matter, in this analysis over and above what's already in the baseline demand forecast.

So and for the last question, no. We're

not doing any targeted deployment at all because the scale of analysis here is the scale for IRP planning, transmission planning, even transmission load buss analysis is for most utilities at a level of granularity far above what you would want for actually targeting appropriate DER deployment. So no, we're not tackling that.

MS. JAVANBAKHT: Thanks, Mike. That's all the questions online.

COMMISSIONER MCALLISTER: Well great. Thanks for everyone's engagement. Really, really appreciate those questions. And the chat has been, or the Q&A, seen some of the some of these questions floating around there so a lot of questions during the course of the session. So really appreciate that.

Let's see, we have no other questions. So let's see, do we just need to -- we are -- we do want public comment. I don't know if you want to go through that, Heather.

MS. RAITT: Yeah, we still [indiscernible]. We'll go ahead and do public comments. Thanks, Commissioner.

So RoseMary Avalos from the Public

Advisor's Office is here to help us with public comment.

MS. AVALOS: Minutes per speaker. If there are several parties interested in commenting, we will reduce the time to one and a half minutes per speaker. So we'll go ahead and move on to Zoom calls, because within the audience we don't have any comments.

So if you're using the online Zoom platform, use the raise hand feature to let us know you'd like to comment and we'll call on you and open your line to make comments. For those on the phone dial *9 to raise your hand and *6 to mute and unmute your phone line. And we will unmute your line from our end.

So I'll first call on the folks with the raise hands on the feature -- on the Zoom feature and please do not use the speakerphone feature when talking because we may not be able to hear you clearly.

So Mark Roest, go ahead and open your line and please state and spell your name and state your affiliation, if any, for the record. You may need to unmute on your on your end, Mike. Mark. I'm sorry.

MR. ROEST: Did that do it?

MS. AVALOS: Yes. Yes.

MR. ROEST: Okay.

MS. AVALOS: And go ahead and spell your first and last name and state your affiliation, please.

MR. ROEST: Sure. My name is Mark Roest; M-A-R-K, R-O-E as in Edward-S as in Sam-T as in Tom. And I'm with Sustainable Energy Inc. And so I got the question that I had written in answered that are not addressing these questions and we're not addressing the possibility of gradually shifting to a non-grid or a distributed micro-grid way of earning the grid.

So if this happens, okay, if it de facto happens in the market with a major infusion of new technology and mass production methods of producing it, what -- how will you do this? How will you react to it? And will it be possible? And can you support the CCAs in their -- in their business model and, you know, and pull withdraw support from the utilities and their business model and just use them as a servant. That's it. Thank you.

MS. AVALOS: Thank you, Mark. Now we'll

move on to the next commenter, Vazken, and please state and spell your first and last name and state your affiliation, if any. Go ahead. Your line is open, Vazken. You may need to unmute on your end.

MR. KASSAKHIAN: Hi. Yes? Can you -- can you hear me okay?

MS. AVALOS: Yes.

MR. KASSAKHIAN: Okay. Thank you. Hi. Vazken Kassakhian. That's V-A-Z-K-E-N. Last Name; K-A-S-S-A-K-H-I-A-N. And my affiliation is Southern California Edison. Thank you.

So first off, thank you to the Commission for your vision and leadership here in initiating the policy based demand scenario forecasting effort. Big thanks also to the CEC forecasting team for taking on the extra work, collaborating with stakeholders, including us, to manage the timely development of the Demand Scenarios. The work on these scenarios is of paramount importance to the state's long term planning efforts.

We see the importance for agencies to use load forecasts that reflect the needs from upcoming policies and development, like the

Advanced Clean Cars II and Advanced Clean Fleet Rule that has been discussed. We also see the importance for the forecast to reflect the needs and impacts to put the state on a path for long term decarbonization so we can be well prepared for the grid needs and proactively plan ahead.

We are primarily, I think, really eager to continue to work together on ways in which these scenarios can be made actionable for planning. As is the case for the approved official IEPR forecasts. In the presentation and slides, there was reference to consideration of these scenarios for approval, as with demand, forecasts. We're keenly interested in and supportive of finding a path whereby these scenarios can ultimately be approved to be made actionable, or whereby official approved IEPR Demand forecasts can catch up to the needs represented and discussed here so that stakeholders will be in a better position to plan accordingly to realize the benefits of the futures represented here and to get to where the policies are appropriately guiding us towards.

So thank you again and we look forward to continuing to partner and collaborate with you on

this important initiative. Thank you very much.

MS. AVALOS: Folks on the phone and a reminder to phone users to dial *9 to raise your hand and *6 to mute or unmute your phone line. Okay. Just give it a few minutes for those on the phone. Okay.

Well, seeing that there are no raised hands for those on the phone, that concludes comments for the phone lines. But we do have one more comment raised hand on Zoom.

Ben Schwartz, you may go ahead and open your phone. Please state your name and spell your first and last name and state your affiliation, if any. Go ahead, Ben.

MR. SCHWARTZ: Great. Thank you. Yes, my name is Ben Schwartz. B-E-N; S-C-H-W-A-R-T-Z and I'm the policy manager with the Clean Coalition.

I -- can you hear me? Just making sure. Great. The timer started, it looks like you can. Okay.

I just want to make a few comments. The first is thank you for all the hard work that went into these scenario planning, Demand Scenarios and forecasting. I asked a question

earlier about a strategic DER deployment, and so this is kind of a broad comment on the IRP and forecasting processes that currently do not accurately take into account the benefits and value of DER in the planning process, in the same way that non distribution, i.e. transmission level resources are considered.

And so I think that this forecasting is the first step and it's very important, and the next step has to be, well, what is the impact going to be in terms of cost effectiveness and rates? So how are these costs going to be allocated to the ratepayers? And one of the earlier slides said that when the utilities were contacted about this and the effect of transportation or electrification on rates, there was little to no comments about that and how it would affect rates.

So the first issue is, you know, better utilizing DER and the multiple value streams they provide, including resilience, which is of key importance with wildfire issues and other natural disasters.

And the second thing is just cost effectiveness and what our current planning and

forecasting will end up looking like for the actual rate payers. I just want to bring up that CAISO recently put out a report for transmission planning over the next two decades, saying that there would need to be around $30 billion in initial CapEx costs. Now when, you know, continued over the lifetime of the project, which is 30 to 40 years, operations and maintenance costs can end up being ten times that, meaning that the state is looking at more like $300 billion when it comes to simply simple transmission investments. And you know, this gets allocated back to the consumers via transmission access charges.

So the next part of the equation, as I see it and as the clean Coalition sees it, is not only how are we forecasting and are we doing so in the most granular way possible, but also how will this result in a cost effective solution for the state?

Once again, thank you for the work and I look forward to continuing to collaborate on this issue. Thanks.

MS. AVALOS: Are there any other commenters? Use the raised hand feature.

Okay. Now seeing that there are no raised hands, that concludes the public comment period.

Now I'll turn to Commissioner McAllister for closing remarks.

COMMISSIONER MCALLISTER: Well, great. Thank you, RoseMary. And thanks for everyone for your comments and for participating today, listening in and mulling a lot of this over. It's a lot to take in and some complex, you know, many, many inter-related topics. So you know, we need all the help we can get, both, you know, from our excellent staff, some of which you all heard from today, but also from our, you know, immense group of knowledgeable stakeholders in California, which are key to getting to good decision making generally, and certainly helping guide this conversation as well.

Highly technical and lots of interrelated topics, I think in an unprecedented way actually, compared to how we did electricity and energy system planning in the past. So it's really vital that we make progress on these various issues together.

So, Commissioner Monahan, did you want to

wrap up with any comments?

COMMISSIONER MONAHAN: It's still really nice to see all of you guys and it's been really interesting and informative. I learned a lot, so thanks for the conversation and look forward to deepening it in the future. And really as we learn and grow and change our modeling to really intersect with where we see technology going, where policy is going, it's a very vibrant time. No shortage of analysis needed for the future. So thanks to everybody.

COMMISSIONER MCALLISTER: Yeah.

COMMISSIONER MONAHAN: And again, thanks to Heather and the IEPR team for all this hard work.

COMMISSIONER MCALLISTER: Absolutely. And, you know, new technology, new possibilities, and programs, and policy technologies are going to open up as we move forward. And so I think we're getting ourselves prepared for you know, both challenges and for positive solutions that are going to emerge.

And so we need comments, additional comments by April 21st. And invite everyone and anyone to submit their written comments, so

please do that. Again, very important. And I will just echo all the comments about how nice it is. It's a little odd to be sort of truly hybrid. The first meeting that I've been in like this, but it's been really great to see people in person and begin to sort of get used to living in three dimensions once again. So it's a perfect venue for that.

So with that, again, I want to thank Heather and the IEPR team, Raquel and everyone for making -- for keeping those wheels turning and keeping them on the bus.

So and with that, I think we are adjourned. Is that right, Heather? With nothing else you need to add? Great. Okay. Well, we're adjourned for the day. Thanks, everyone.

(Meeting adjourned at 4:49 p.m.)

CERTIFICATE OF REPORTER

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

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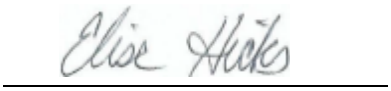
IN WITNESS WHEREOF, I have hereunto set my hand this 11th day of May, 2022.



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

MARTHA L. NELSON, CERT**367

May 11, 2022