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CALIFORNIA ENERGY COMMISSION

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	)	RE: Demand Forecast

IEPR COMMISSIONER WORKSHOP ON UPDATES TO

CALIFORNIA ENERGY DEMAND 2022-2035 FORECAST

REMOTE ACCESS VIA ZOOM

WEDNESDAY, DECEMBER 7, 2022

10:00 A.M.

Reported by:

Martha Nelson

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P R O C E E D I N G S

10:01 a.m.

WEDNESDAY, DECEMBER 7, 2022

MS. BAILEY: Good morning. Welcome to today's Commissioner workshop on updates to the California energy demand 2022 to 2035 forecast. I'm Stephanie Bailey with the Integrated Energy Policy Report Team, and I'll make a few logistical announcements before we get into the substance of today's workshop.

Next slide, please.

Alright, so this is a remote only workshop. So to follow along, the meeting schedule and presentations have been docketed and are posted on the CEC's IEPR web page. All IEPR workshops are recorded and a recording will be linked to in the CEC website shortly after the workshop and a written transcript will be available in about a month.

Attendees today can participate in a variety of ways. We will reserve a few minutes after the presentations to take a few questions, but we may not have time to address all the questions submitted. And for those joining us via the Zoom platform, the Q&A feature is available for you to submit questions. You can also upvote a question submitted by someone else. You just click the thumbs up icon to upvote and questions with the most up

votes are moved to the top of the queue.

Alternatively, attendees can make comments during the public comment period at the end of the day. So please note that we will not be responding to questions during the public comment period.

Written comments are also welcome and instructions for providing those are in the workshop notice posted on the CEC IEPR web page. And written comments are due December 21st.

With that, I will go ahead and turn it over to Ben Finkelor, who is Chief of Staff for Vice Chair Siva Gunda, who is the Lead Commissioner for the 2022 IEPR Update for opening remarks.

Go ahead, Ben. It looks like you're muted, Ben.

MR. FINKELOR: Here we go. Is that better?

MS. BAILEY: Perfect. Go ahead.

MR. FINKELOR: Okay. Alrighty. So you can tell I'm not the Vice Chair, but I'll do my best to channel him today. Thank you all for being here today. And of course, thank you to fellow Commissioners.

I'm going to, as I channel the Vice Chair, I know he'll want to acknowledge a number of the people that made today possible. And so just to think again, I think we'll be joined with Commissioner McAllister and Commissioner Vaccaro later today. So, of course, thank you in advance

for their participation.

And then thank you to you, Stephanie, for stepping up. Usually Heather, Heather Raitt, plays this role. But, again, thank you to her too. I know she's out with COVID, so hopefully she is recovering nicely. Today's a lot of work, to put together the work together today, and to work on this particular workshop. So special thanks to both you and Heather and the whole IEPR team. And then, of course, splitting this into two workshops, I know that's additional challenges.

I want to thank Aleecia Gutierrez, David Erne, and their leadership with the Energy Assessments Division. And then, of course, our presenters today which includes the California Energy Commission staff, Heidi, we're going to hear from. Thank you, Jesse, Aniss, Bob, Quentin, all of you, thank you for your work.

And just a special note. I understand this is Bob's last IEPR workshop before he retires at the end of the year, so we're going to definitely miss his wealth of knowledge on, on the medium-duty/heavy-duty vehicles. And of course, his collaborative spirit, as well.

And then just thank you for the work to the whole Transportation Forecasting Team for their work in developing this additional achievable framework, which is included in the workshop.

I want to thank Ingrid Neumann and Ethan Cooper, as well as thank Mike Jaske and the Efficiency Analysis Team for their foresight in modeling the impacts of the zero-emission space and water heater measure.

And just also want to thank our sister agencies, California Air Resources Board, for their collaboration and input, both on the transportation forecast and the zero-emission space and water heater measure, as well as the JASC (phonetic) members, both CPUC, CAISO and CARB for their valuable feedback and collaboration on the forecast changes this year.

So we really want to acknowledge all of the work that's been put into this. And I'm looking forward to participating in this.

I see that now -- I'm an amateur at this. So I see that the Vice Chair is already here, so I should have turned to pass the ball to him right away. And I see Commissioner McAlister as well.

So with that, Vice Chair, do you want to -- did I leave anybody out in terms of acknowledgments?

VICE CHAIR GUNDA: No, you did great. I mean, I just want to add a couple things to what you just said, Ben. Thank you for framing that.

And I want to, first of all, thank Commissioner McAllister for his kind of role in kind of helping the

forecast move forward. You know, we Commissioner McAlister and I, work on this together, but also just the foundational nature of forecasting as a planning entity or a planning framework for everything we do in California. It's so foundational.

Really appreciates the staff's openness to embracing some of the innovations that are being required in terms of moving, you know, from forecasting to more scenarios in terms of planning. So, yeah, just big things.

And thanks to you, Ben, and the team for doing all the work.

So with that, I'll pass it on to Commissioner McAllister if he has any of my comments.

COMMISSIONER MCALLISTER: Yeah, well, thanks. Thanks, Vice Chair Gunda

Thanks, Ben. Nice job. You come across as a real pro so, you know, all good.

Yeah, you know, this forecasting is really -- I think we sometimes lose a little bit of the context here more broadly of how important -- you know, we sort of take it for granted a little bit here that this is a foundational resource and our agencies work together and we all really much effort and activity keys off of the forecast.

And, you know, I was just, a couple months ago,

in Australia. And, you know, the beauty of our forecast is that it really is a ground up and it really comes from, you know, all of these different load modifiers. You know, it's not just about how much energy people use, it's what they use it for and how those demands are changing.

And so we keep adding these modifiers on the positive, sort of the additional consumption side on, say, transportation and on electrification, we have new loads, we're trying to characterize those. On the energy efficiency side, you know, obviously on the self-generation side, we sort of have load modifiers that push the other way in terms of how much energy you know, passes across the meter.

And so that I think, you know, this dynamic world that we're in where, you know, it is extremely granular, it's extremely atomized, and every consumer has an influence on the grid's load shape. And, you know, we capture that and increase, you know, update the forecast, you know, all the time, really every cycle to capture those influences and really have that situational awareness and project these trends forward in a very intentional way.

In Australia, you know, they just do -- they don't do that. And so they're faced with system crises that are -- that they don't have visibility on because they're generated by, these issues are generated by,

massive proliferation of rooftop solar, inefficient buildings that they could be working on, but they can't really forecast the -- they don't have the tools really to forecast the impact of those efficiency investments or those building electrification decarbonization investments. And so their forecast can't drive policy because they don't have that kind of visibility. And that pretty much is everywhere else in the world except California.

And so we're really lucky, I think, to have the expertise and to have this team in place that allows us to do these scenarios that Vice Chair Gunda mentioned and to be able to drive policy and optimize policy approaches and investments from the bottom to the top and the top to the bottom of the whole energy system, or electricity system, certainly, and, you know, and analogously with the gas system as well.

So I think, anyway, I'd want to just take stock and appreciate the process and kind of highlight the importance of these new approaches that are giving us visibility into all the different policy directions that we're going and quantifying the benefits and helping us prioritize investments across the state, starting, you know, with individual loads behind the meter in houses and businesses. So I think that's unique to California and it's really special. And I wanted to just highlight that

for everyone as we kick off and appreciate all the staff that's working on these tools, so look forward to it.

VICE CHAIR GUNDA: Thank you. Yeah, thank you, Commissioner McAllister. I think you make such important points of the foundational nature of the forecast.

As I'm reflecting on all the names that Ben called out, I joined a little late, so I don't know if Nick was called out or not, but I just want to give a big kudos to Nick Fugate for the amount of work that he has been shouldering and continues to shoulder in making sure we complete the forecast on time and with the rigor that's necessary. You know, we have, you know, unfortunately, lost a few members from CEC in terms of the Forecasting Team. It almost feels like, you know, Nick has been doing this Herculean effort every year, year after year, and then continues to do that.

So thanks, Nick, for your commitment in making sure the forecasting product is as good as possible for state to really plan the policies around.

You know, just with all that, I'm looking forward to the workshop, you know, going through the first half of the workshop today. And I think we are going to turn it over to Heidi.

So, Heidi, please go ahead.

MS. JAVANBAKHT: Alright. Thanks, Vice Chair

Gunda. Thank you, Commissioners.

Good morning, everyone. Thank you all for joining. I also just wanted to express my gratitude to the IEPR Team and all the Commissioners on the dais, as well as everyone attending this morning, for your flexibility in splitting what was a full-day workshop into two half-day workshops.

And, Stephanie, if you could go to the next slide? And the one after that. Thank you.

Okay, so on the agenda for today, we'll be reviewing results for two components of the Energy Demand Forecast. First up, we'll have the Transportation Energy Forecasting Team covering their results, followed by the Energy Efficiency Team, who will present their updates to the additional achievable fuel substitution.

And then we've scheduled a second workshop for the afternoon of December 16th to discuss the sales results and the hourly and peak forecast results. Several forecast components required some extra time this year to finalize, which pushed back rolling up all the different forecast components. So we just found ourselves needing an extra week to finish up the QC and review the combined results, hence the need for pushing the second half of this workshop to the 16th. And I hope you will all join us for that.

Next slide.

The Energy Demand Forecast has a lot of different data and models feeding into it. For today's workshop, we'll be focusing on the baseline and the additional achievable transportation electrification components that are shown on the left side of the screen, and then the additional achievable fuel substitution that's shown on the bottom right.

Once all these components are completed, they are rolled up into the overall end user consumption and sales statewide and by planning area, which is in those orange boxes. And the last step is to produce the hourly forecast and calculate the one-in-X peak event values. So the results in those orange boxes are what we will be presenting on December 16th.

And next slide.

The forecast this year is an update to the 2021 Forecast. The routine updates include adding an additional year of historical data, updating projections of economic and demographic data, and updating the electricity rates. We also update the hourly and peak demand forecast every year, and we incorporated data from September's record-breaking heat and peak load events.

The main changes for this year are the bolded bullets. The first is the update to additional achievable fuel substitution, or AAFS, to layer in the estimated

impacts from the zero-emission space and water heater measure that's in CARB's State Implementation Plan, and you'll hear more about this later this morning.

And then we've transitioned, also, to a new forecast framework and to using an additional achievable framework for transportation that's similar to what we use for energy efficiency and fuel substitution. The new forecast framework simplifies the number of permutations of the forecast to focus on the combinations that the utilities, the Independent System Operator, and the Public Utilities Commission use for planning.

The additional achievable framework for transportation allows for more flexibility and scenario design that better captures the uncertainty in this rapidly changing sector.

Next slide.

This is the forecast framework for the 2022 Forecast. The biggest change from previous years is that we have eliminated the low and the high case, and we're just focusing on the mid case. And then similar to previous years, the mid case has different additional achievable scenarios added onto it depending on the use case.

We will also be moving away from the nomenclature of mid-mid and mid-low and refer to these based on their

use cases. So the mid-mid is renamed as the planning forecast and the mid-low is renamed as the local reliability scenario.

The planning forecast includes Scenario 3 from all of the additional achievable components. So the AAEE, which is the energy efficiency, AAFS, which is the fuel substitution, and AATE, which is the transportation electrification. The planning forecast uses Scenario 3 for all of those.

And then the local reliability scenario has higher load than the planning forecast in order to take a more conservative approach in the local planning studies. So for this, we are including Scenario 3 again from AATE, the transportation, Scenario 2 for AAEE, which has less energy efficiency than Scenario 2 -- or sorry, less energy efficiency than Scenario 3, and then we'll use Scenario 4 for AAFS, which contains more electrification than the AAFS Scenario 3.

The local reliability scenario will also have the CARB's State Implementation Plan Strategy for the zero-emission space and water heating equipment sales after 2030. That's layered on top of the AAFS Scenario 4.

And next slide, please.

More details around these updates and the assumptions and inputs to these different scenarios were

discussed at Demand Analysis Working Group meetings held earlier this year. Presentations from those meetings are posted online. And the link to the DAWG meeting is at the bottom of this slide.

And then the timeline, here's the timeline for finishing up the forecast. The Draft IEPR has already been posted. And then due to the timing of posting the draft and the timing of completing the forecast, the forecast results presented today are not included in that draft, but they will be added into the final version that's posted in February.

And as mentioned, part two of this workshop will be held on December 16th to cover the consumption, sales, and peak load results.

After that, we'll be reviewing comments and finalizing results, which will go to a business meeting for adoption in January.

And with that, I will hand it over to Aniss Bahreinian, who is a subject matter expert in transportation forecasting. And she will kick us off with the transportation forecast discussion.

MS. BAHREINIAN: Thank you, Heidi. My name is Aniss Bahreinian, and I am presenting today the total Transportation Energy Demand Forecast. And this is the end result of the work that is done by all of our staff. It is

a team work. So I'm only the presenter here, and there are a lot of other Staff who have been working on these results and these end results. And the end result of our transportation forecast is the fuel consumption forecast, which is used by different agencies.

I will first look at the -- next slide, please. Okay.

I will first look at the transportation energy demand and where we are by fuel and vehicle type. And then I would move to ZEV transportation Energy Demand Forecast. And at the end of these PowerPoints, there are appendices that include transportation energy forecast for other fuel types, not just ZEV fuel types, but other fuel types like gasoline, diesel, et cetera.

You can also find transportation energy price forecast at the end of this appendix

Next, please. Next.

Alright, this is the traditional three-legged stool of transportation energy consumption. And then any one of these three factors, whether it is vehicle miles traveled, fuel economy, or vehicle population, when they change, the total transportation energy consumption is going to also change. When we are in the transition process from one fuel type to another fuel type, which is currently the state, we are moving from fossil fuels to

clean energy like electricity and hydrogen, in this process, fuel type distribution also matters.

And it is important to note that when two of these factors are changing, they can result in, given the fuel type distribution, they can result in situations where transportation energy consumption can go in unexpected places.

For instance let's take the case of EVs. When we have EVs, obviously, they are more efficient. And so we are expecting that total transportation energy demand could go down because EVs are more efficient than gasoline vehicles. But then if drivers, because they are paying lower fuel costs, they drive more, that means VMT is going to go up, so then two of these factors are going to go up. It is both fuel economy and vehicle miles traveled. Increasing fuel economy is going to drive down transportation energy but increase in miles traveled or vehicle population is going to increase transportation energy.

Next slide, please. Thank you.

This is where we are in 2021. These are the actual numbers or estimate of the actual numbers. As you can see, gasoline is speaking the first word. It is used in both light-duty vehicles and medium- and heavy-duty vehicles. And it is clearly dominating the transportation

energy.

This is followed by jet fuel. It is in second place at 4.3 billion GGE. And please note that we have converted everything to GGE so that they are comparable to each other. Note that what we are accounting for is all the jet fuel that is loaded onto the planes departing from the state of California.

Now these planes can go anywhere. They can go to within the state, they can go interstate to other states, other states in the U.S., or they can go to international destination. And we have a lot of international flights in California.

And last time I was looking at the numbers, about 40 percent of jet fuel was for international flights, which also have much longer distance than the intrastate or interstate. And so all of this 4.3 billion GGE is not just for California, it is for the tourists, it is for people from other states who are coming, going to other countries, et cetera.

In the third place, is diesel. And as you can see here, diesel is used both in rail, as well as in medium- and heavy-duty, and in light-duty vehicles. And the predominant use of diesel is in medium- and heavy-duty, which is going to be covered by Bob McBride.

Electricity, hydrogen, ethanol, and propane

hardly even show up, so the numbers are pretty low, in 2021, electricity is at 92.2 million GGE. But keep in mind that the amount of electricity that looks very low here, this needs to be multiplied by a bigger number, like three or so, if you want to determine how much petroleum fuels have been reduced as a result of this, because electricity consumption, again, is 92 GGE, but the amount of gasoline that it replaces is much higher.

The same thing is true with hydrogen, which is even lower at 1.6 million GGE. Natural gas shows up a little bit. But this is used mostly in medium- and heavy-duty and in transit buses and trucks. And propane is used, for the most part, in medium- and heavy-duty vehicles.

Next slide, please.

Alright, so this slide, the graph that you see here, note, first of all, that we have changed the scale a little bit, starting at two, because we wanted to show clearly that there is a decline between 2022 and 2035. This is measuring all of the transportation energy in the state of California, whether it is rail, medium-duty, heavy-duty, neighborhood electric vehicles, off-road transportation, et cetera. All of these are included in this total transportation energy demand. The unit is BTU, again, so we can add them all up here.

As you can see here, there is a decline in this

transportation energy demand between 2022 and 2035. This is important in light of the fact that California economy grows by about $1.3 trillion between 2022 and 2035, California population grows by about 2.5 million between 2022 and 2035, and yet we see the decline in transportation energy. So there are more people in California, more production, but less transportation energy. The vehicle population goes up as a result of all these, VMT goes up, and again, transportation energy is going down.

This is mostly the result of using the more efficient vehicles like EVs and hydrogen fuel cell vehicles. That is what is causing this decline. Otherwise, the number of vehicles, as Jesse and Bob are going to show later, are increasing. So kudos to growing efficiency in transportation in California.

Next slide, please.

This slide is showing total electricity demand, except that we are not including neighborhood electric vehicles here. We are showing transportation electricity that is used by light-duty vehicles, by medium- and heavy-duty vehicles, and by rail. As you can see here, even in 2035, light-duty vehicles are still dominating. There is growth in both medium- and heavy-duty and light-duty vehicles' electricity consumption, though rail seems to stay stable between 2022 and 2035. So we can see the

increase in both of these but still dominated with light-duty vehicles.

Next slide, please. Next. Thank you.

And this one is showing transportation hydrogen demand by sector. So this one is showing, again, that light-duty vehicles are dominating, and there is definitely room for medium- and heavy-duty vehicles. They are both growing over time, but not nearly as much as electricity demand is growing. So electricity demand is gradually dominating transportation energy over time.

Also, I should add that all of these scenarios that we are presenting here, the ones that I am presenting and Jesse and Bob are presenting, these are what is referred to as baseline transportation forecasts. Baseline is equivalent to what we used to call mid-case or reference case in prior IEPRs.

If you recall in prior IEPRs, we have been also forecasting a high and a low. And the reason for forecasting the high and low in prior IEPRs was to cover the uncertainties that are inherent, not only in the economy and in population, but also in technology. In the case of PEVs, if you recall from last IEPRs, we actually had five scenarios. Because in addition to economy and population, we also had technology uncertainties that we covered, or we tried to cover, in different scenarios that

we have presented in the past.

In this IEPR for 2022, we are only presenting the baseline mid case or reference case scenario, but the uncertainties are remaining. And even our prior IEPRs, if you go back to, say, 2021, we had, let's say, gasoline prices. As long as our forecast was staying within the high and the low bound, we would consider it a reasonable forecast. But nobody could predict the changes that happened in the oil market in 2022. No forecast could predict that. So the 2022 gasoline price shock actually went outside the bound of even the high case in 2021 forecast. And not just ours, but everybody else's.

So even using the high and the low, we're still not certain that we are covering all of our uncertainties. Unexpected things happen. And even in the current market, you can imagine that we are generally using the baseline income scenario from Moody's Economy.com. However, there are debates among the economists on whether there is going to be a recession in 2023 or not.

We also know that autonomous vehicles are advancing. And maybe by 2030, we will have autonomous vehicles on the road and things could change. All of these are going to throw uncertainty into the forecast.

So we cannot expect that our baseline forecast is going to be exactly met. That's the bottom line. It will

be deviated. The actual data will be deviating from the baseline forecast.

Just last week, for those of you who have been following some of this news, you know that we have the IRA, Inflation Reduction Act subsidies for ZEV vehicles. But last week, President Macron of France, in discussions with the administration, was complaining about the fact that IRA is targeting the American manufacturers. It is providing incentives that are targeting the American manufacturers.

So what is going to be the result at the end? We don't know yet. But all of these are different uncertainties that are out there. And we need to be considering them at some point and maybe in the next forecast we will.

With that, I'm going to pass this to Jesse Gage, who is going to make a presentation on the light-duty vehicle stock.

Thank you.

MR. GAGE: Thank you, Aniss. I will be touching briefly on the light-duty vehicle historical stock of our baseline forecast. The AATE scenarios will be handled by Quentin towards the end of today's session of the workshop.

Next slide, please. Thank you.

This chart is the total light-duty vehicle stock, historic and our baseline forecast. First of all, I wouldn't put a lot of weight to the 2015-2016 numbers. I

think that's probably an issue with the DMV processing. I'll have to look at that. What is real is the small dip you can see in 2020, showing the impact of the pandemic on vehicle sales.

Going forward, we see a steady increase, largely in line with population and socioeconomic factors increasing by about 6 million vehicles over the forecast period from 2022 to 2035.

Next slide, please. Next slide. Thank you.

ZEVs have grown steadily from 2011 to 2017 in terms of their market share; that is the percentage of light-duty sales which are zero-emission vehicles. There was a significant uptake in market share in 2021 a, as the Model Y was a smashing success, along with the continued sales of Tesla's Model 3. And then, of course, in 2022, sales have almost, in a way, gone through the roof, partly because of increased models and, of course, the markedly high gasoline prices we've all been seeing this year.

Next slide, please. Thank you. Here you can see total zero-emission vehicles, stock, historic and baseline. I'll go over the various milestones here.

Our goal of 1.5 million vehicles on the road by 2025, we think we will hit next year. There was a lot of celebration whenwe hit 1 million last year; 1.5 next year is pretty much in the cards. We should be over our 5

million target by 2030. And by 2035, we should be hitting just about 10 million vehicles. Again, this is in our baseline forecast.

Next slide, please.

Can you believe there was a time when plug-in hybrid vehicles were actually outselling battery electric vehicles? That was the case in the early years of this revolution as the Chevy Volt proved popular and was selling quite a bit in the early years. However, it was discontinued in 2018, the same year as Tesla's Model 3 was introduced. BEVS overtook it that year and haven't looked back. We do see about a million PHEVs on the road by 2035, but BEVs will be outnumbering them nine-to-one.

Next slide, please.

Here we have hydrogen, little hydrogen. You can see here, first look at the historic. Actually, before anything, note the scale here:this is in thousands of vehicles rather than millions like the previous ones. There was a slight pause in hydrogen vehicle sales in 2020 because the Toyota Mirai itself took a pause in production for that year. After that, though, we do see a steady modest increase in hydrogen vehicle stock, turning out to about a little under 90,000 vehicles by the forecast horizon year of 2035.

Next slide, please.

And finally, I wanted to call this article out a little bit. We've had something about hydrogen plug-in fuel cell vehicles, in other words, vehicles that are primarily hydrogen but you can plug them in to charge their battery, much like a gasoline-powered plug-in hybrid vehicle of todayWe've had them in our forecast for several years.

We never actually saw them in the industry, but now we have this press article here from Car and Driver showing that Honda has actually announced one for sale in 2024. We don't see here the huge uptake of these because we don't forecast many makes and models here. But I did want to point this out because, Sudhakar, if you're listening to this, you called it. Thank you.

And with that, I'll turn it over to Bob for heavy-duty.

MR. MCBRIDE: ~~Sorry about that.~~ Good morning, Commissioners, stakeholders, colleagues from other agencies and fellow staff. I'm Bob McBride and one-third of the Medium- and Heavy-Duty Vehicle Energy Demand Forecasting team, along with Maggie Deng and Elena Giyenko. This presentation covers the baseline case for medium- and heavy-duty vehicle stock.

Next slide, please.

On the right, you'll see typical vehicles in

their weight classes, which was mostly put in as a reference for those with new interest in these vehicles. I'll talk about weight classes 3 to 8 with the gross weight rating of 10,000 pounds and more.

We characterize vehicles and the models, assigning vehicles to classes that can easily be compared to the set of vehicles created for the Air Resources Board EMFAC model 2021 version. I'll review some key inputs and assumptions regarding regulation in the various truck markets. And we'll look at reference case outputs or baseline case outputs that tally to the vehicle stock accounts.

Other forecast components, like growth and goods movement and the economy in general, are handled using the same methods as recent IEPR forecasts, but updated, characterized in previously documented workshop and demand analysis work group presentations, if you want to find them.

Next slide, please.

Here we see the vehicles. The seven columns are broad vehicle types, motorhomes, buses, and five flavors of trucks. Class 3s are mostly pickup and van bodies used also in light-duty, but with four tires on the rear axle. The heavier weight bearing allows them to be rated as Class 3.

Class 4 to 8 comes as articulated tractor trailers and transit buses, or as straight trucks, buses, or motorhomes. Tractor trailers can be licensed for interstate or only for in-state movement. Class 8 refuse and recycling and dump trucks have significant power use aside from the drivetrain and unique drive cycles, so they get their own classes. EMFAC now also calls out Class 8 cement trucks, which for 2022 will still count with other Class 8 straight trucks. Buses in Class 3 to 8 fall in four categories, urban transit, school buses, intercity motor coach, think Greyhound, and shuttles and other buses.

Next slide, please.

Now we turn to our modeling assumptions. Compliance with the statewide Truck and Bus Rule, the Innovative Clean Transit Rule and the Advanced Clean Trucks Regulation are baked into all our scenarios, including baseline. Also, the Regional South Coast Truck Rule is included. The Hybrid Zero-Emission Truck and Bus Voucher Incentive Program -- a mouthful -- often called HVIP, simplified voucher amounts a couple of years ago so they weren't hopping around year to year. So now all trucks and buses in a given weight class received the same amount going up to $120,000 for Class 8.

One exception is the port drayage trucks targeted to be 100 percent ZEV rolling stock by 2035 in the Advanced

Clean Fleets proposed regulation, which receives $150,000 as an incentive for ZEV. Since the Advanced Clean Fleets proposed regulations are not yet in effect, that measure will be covered by Quentin in the next presentation.

For HVIP, we're holding the flat ZEV or NZEV, near ZEV, which is the medium and heavy way of saying plug-in hybrid, we're holding the ZEV and NZEV voucher flat, almost constant, through 2023, reducing or increasing after that to achieve advanced clean trucks compliance.

From 2024 forward, we scale the existing voucher amount in the advanced clean truck categories as a proportion of the incremental purchase price. In other words, if the price of the ZEV relative to a base fuel like a diesel, if that goes down, also the voucher amount goes down. An incremental price is the difference between the ZEV truck price and the same truck using the base fuel. The proportion can be changed starting in 2024 to achieve the ACT compliance.

This year, the Inflation Reduction Act, or IRA, popped up. 2022, Congress passed the law to, among other things, incentivize medium- and heavy-duty vehicles. The IRA can be stacked with HVIP vouchers, as far as we know. We did ask CALSTART about this, but the federal regulation is not yet final, so we'll wait to look for that.

VICE CHAIR GUNDA: Hey, Bob.

MR. MCBRIDE: Yeah?

VICE CHAIR GUNDA: Hey, your voice is coming a little faint. If there is a way to, yeah, on your end -- thank you.

MR. MCBRIDE: Oh, sorry. I'll speak up. I'm on earbuds, and I have the laptop volume cranked up, so this is what we'll get. I'll just try to speak loud. Thanks~~, Siva~~.

Where was I? Class 3 vehicles with electric drives can receive up to $7,000 or up to $40,000 for Classes 6 and 7. Field prices follow our reference or baseline scenario field prices. You'll see later that the baseline fuel price is not favoring ~~tied to~~ hydrogen fuel cell vehicles, but this is our baseline case. We assume the same fuel efficiencies by class and model year as used in EMFAC 2021.

Next slide, please. Thanks.

We see modest growth in the size of the medium- and heavy-duty fleet from around 970,000 in 2022 to 1,088,000 in 2035. Over this period, the diesel fleet shrinks by 20 percent, while the battery electric fleet grows from under 3,000 to something like 256,000 in 2035. The natural gas fleet also grows from about 37,000 to over 57,000 in 2035.

Next slide, please.

Now we drill down to weight class, Classes 4 and 5, which we lumped together, including delivery trucks and other vocations. The Class 4 and 5 truck fleet grows from under 158,000 in 2022 to over 256,000 by 2035. Diesel holds a fairly constant count, while battery electrics grow from about 2,000 to over 141,000 by 2035. The natural gas fleet grows from just over 5,000 to over 10,000 by 2035. Gasoline hybrids also grow from about 400 to over 21,000 by 2035. While the propane fleet decreases, and these are both mostly in medium-duty trucks and buses, the propane fleet will decrease from 10,000 to 5,000 over the same period.

Next slide, please. Thanks.

In this presentation, we define ZEVs the same way as the Advanced Clean Trucks Regulation, which is a little quirky, but it includes battery electric, hydrogen fuel cell electric, as well as plug-in hybrid vehicles with a minimum number of all electric miles. We'll call these near ZEV or NZEV. Few, if any, motorhome ZEVs are likely by 2035, but we expect over 263,000 ZEV trucks and buses by that year.

Next slide, please.

So now we take a look at the Class 8 in-state tractor trailers. The tractor trailers including interstate ones are about half of the diesel fuel consumed

in the state. The forecast shows an increase from about 101,000 in 2022 to over 146,000 in 2035, and this is grown strictly based on the freight analysis framework expectation of the number of tons moving around. Despite the 45 percent growth in demand for these trucks, the diesel truck count grows about 5 percent in the same period. From a handful of battery electrics in 2022, the forecast reaches about 39,000 of these tractor trailers in 2035.

Next slide, please.

Here we see the only slide that's not a vehicle stock count. It's a fuel type share. The share of trucks by the same Class 8 in-state tractor trailers over the same period. Generally, the battery electric achieves an equal share of new sales with diesel in about 2031, which happens to be the final year the IRA incentives are available.

These shares from 2029 to 2032 vary in part with the presence or absence of the IRA incentive, but also bounces around as a function of how we set the HVIP voucher amount. We do this for a minimum run of two years so that the voucher amount isn't popping all around, and this creates some certainty for the fleets. The share will be constant from 2029 to 2032, but we have a drop in ZEVs in 2030 for that reason, the constant voucher.

The takeaway here is that implementation of

incentive amounts is a balancing act, in this case, achieving ACT compliance through the period when the IRA is sunsetting.

Next slide, please.

Thank you for your kind attention. This work has expanded in scope over recent years, and Maggie Deng will continue improving it in the future.

Now we'll turn to the new additional achievable scenarios presented by Quentin Gee.

Here you go, Quentin.

MR. GEE: Great. Thank you, Bob.

Yeah, so hi, my name is Quentin Gee. I'm the supervisor for the Transportation Energy Forecasting Unit, and also currently working with all of the Advanced Electrification Analysis Branch.

What I'll do today is I'll discuss the AATE framework, or Additional Achievable Transportation Electrification framework, and some of the results.

So let's move on to the next slide. We can go ahead and get started.

There's a lot of text here, but just to kind of, I guess, set the context for people that haven't been a part of some of the planning discussions here with the Demand Analysis Working Group and some of the more technical discussions, we have switched over to a new

framework for developing the planning scenarios, planning forecasts, using AATE. This is similar to the Additional Achievable Energy Efficiency and Additional Achievable Fuel Substitution that you'll hear later on, at least in terms of kind of attentiveness to policy. Some different issues around how these are done, because they're different frameworks, but yeah.

So the basic idea is we're working with what we call a managed forecast, and this is going to be some forecasts that are above the baseline used for integration of supply-side policies that current demand-side models cannot readily account for.

So we are looking at, primarily, AATE 2, Scenario 2 for AATE, and then Scenario 3. They're managed forecasts that post-process some vehicle fuel types to align with sales proportions or population proportions stipulated by policies, key policies such as Advanced Clean Cars 2 and Advanced Clean Trucks. These are both policies from the Air Resources Board. And these frameworks will also allow us to make additional modifications as new policies come into play.

Because AATE 3 is the recommended scenario for planning, and the baseline forecast was actually higher than we expected, we did not do anything with AATE 1 this time around. That may change as we continue to work with

the AATE framework and as it evolves, but currently I think we're -- or at least with this iteration of the IEPR, we did not take a look at AATE 1.

Next slide.

So the first thing that I'll cover in this will be the light-duty vehicles on the next slide here. So looking at AATE for Scenarios 2 and 3, the basic idea is we kind of -- Aniss earlier discussed the baseline framework for the light-duty vehicles. Jesse talked a little bit about the light-duty implications, as well, for the forecast. Basically, we take the same kind of preferences for body styles and the, you know, things such as increasing consumer interest in SUVs or pickups. These are maintained. But what we have done is, by doing a sort of a post-process analysis, allowed for a modeling of different fuel, the consequences associated with switching around the fuel types of the new vehicles that are sold.

In particular, Advanced Clean Cars 2, that regulation that basically says, you know, in 2026, approximately 35 percent of vehicles need to be ZEVs, you know, under a credit system, which is not an absolute forced requirement, but the credit system is designed to approximately achieve that, and that's what we've done as a post-process to the baseline scenario.

AATE 2 was a little bit different. That actually

was less ambitious than Advanced Clean Cars 2. Advanced Clean Cars 2 calls for 100 percent ZEV sales in 2035, which is AATE 3. AATE 2 gets to 100 percent ZEV sales for new vehicles in 2040.

Okay, so taking a look at kind of the overall picture here in terms of light-duty vehicles, we do have lower per-vehicle electricity consumption from the 2021 IEPR. There are a couple reasons for this. And the first one is that we had an increased population-weighted PEV fuel economy, or actually ZEV fuel economy, but electricity, in particular, here, we just sort of doing a vehicle-weighted analysis looking at the fuel economy of vehicles. They actually are greater than they were in the 2021 IEPR.

We also had improvements to the vehicle miles traveled forecast. And also some improvements to the plug-in hybrid electric vehicle energy consumption values as well. So combining all three of those kind of meant that basically per-vehicle or per-electric vehicle consumption went down.

Next slide.

So let's take a look at the overall sort of analysis here. And my apologies, my AATE 2 and 3 lines here are switched, so the green is the orange. The green line here is actually the AATE 3 line. My apologies on

that. But basically you can see that AATE 3 has about 7.1 million zero-emission vehicles and, basically, it rounds to 7.1 million electric vehicles, plug-in electric vehicles in 2030 and then 15.3 million ZEVs in 2035. That's contrasted with the base scenario that Jesse presented earlier where we have 5.4 in 2030 and 9.9 in 2035.

And then with AATE 2 on the chart, that orange middle line, that is more or less kind of in between those two.

Next slide.

One sort of, I think, interesting analysis is to take a look not just -- there's a lot of attention given to the vehicle stock, which I think is really important. A lot of our state goals are geared towards that and that's, I think, a useful framing device for us to really think about, you know, how are we achieving state goals, et cetera, in terms of climate goals as well.

But I think another way to look at it is also the electric vehicle miles traveled or zero-emission vehicle miles traveled. And our forecast results allow us to kind of look at those numbers in broad terms. And so what we can see here is we can look at 2022, the forecast shows that we expect about three percent of the vehicle miles traveled to be zero-emission vehicle miles traveled. But then fast forwarding to 2035, that sort of end cap of our

base, of our forecast, we can see that the base and AATE 2 and 3 grow proportionately.

AATE 3 is the one that we're using for planning. And at that point in time, we have to expect about 45 percent of the vehicle miles traveled to be zero-emission. This contrasts a little bit with the population, as I just showed before, the population is closer to about 41 or 42 percent. But we have slightly more of those vehicles -- slightly more of the miles actually being driven by zero-emission vehicles.

The leading reason for this is because newer vehicles usually are driven more than older vehicles. So you can imagine someone driving, you know, the newest car versus driving, you know, a 2002 car that they have two vehicles in their garage, they might rely on driving one rather than another because of the -- maybe the reliability, maybe it's better for fuel economy, et cetera.

So this is something that I think is an important insight for us to really think about in terms of VMT and state goals. Even though not all of the vehicles are -- not even half of the vehicles are going to be ZEV in the stock at that point, close to half of the miles driven will be.

Next slide.

So the next step on AATE in looking at the

results is we can take a look at freight trucks on the next slide here. So as Bob discussed in explaining the baseline, sort of went through how the forecast incorporates these different factors, things about regulations, incentives, fuel prices, and truck prices, as well as fuel economy, the baseline, we have that. And then we have AATE 2 using a little bit more aggressive assumptions here.

And then AATE 3, actually kind of using a lot of what's in the baseline, but also just kind of, what I would say, is using the population targets as opposed to using the model, again, in that sort of post-process sort of approach to get the populations that we're looking for that align with the policies that we expect in the model.

Next slide.

Okay, and here we have a rough explanation of it. Again, AATE 2, more aggressive prices, better for adoption there for ZEVs. And then AATE 3, we're looking at, again, the percentage outcomes.

And, yeah, let's move to the next slide. Next slide. Yeah, here we go. Here. Thanks.

So again, looking at the truck stock, truck stock is a little bit different here. We're not nearly as large of a percentage of the vehicles, but still we can see this exponential growth in the truck stock here under AATE 3,

approaching about 400,000 by 2035 and about 160,000 or so in 2030, which we think is pretty compelling.

Now this is zero-mission vehicles. There actually are a good chunk of hydrogen vehicles, but still not the majority of the zero-emission vehicles. We do anticipate more being electric here. But there are some, I think, some good penetration there. And maybe if there's some additional questions, Bob might be able to answer those when we get to the Q&A there. But the adoption there, I think we're primarily seeing in the Class 8 sector for heavy-duty trucks.

Next slide. Yeah, here we go.

This is an interesting slide. Aniss kind of pointed to some of this that's going on here with the truck issue. And so Aniss earlier showed how fuel demand was declining for transportation, even though we're getting more transportation services, we're getting more vehicle miles traveled.

And we're seeing a similar phenomenon when we zoom and look at the freight, as well, just the freight sector as well. So we're looking at a trillion BTU here. And you can see that we're kind of going down, but we're seeing a large proportion being zero-emission vehicles. And again, the idea underlying this is that zero-emission vehicles, such as electric trucks and fuel cell electric

vehicles, but just taking a look at electric vehicles, for example, that a kilowatt hour, or maybe even say a Btu of electricity, will provide about two to three times more energy service in a freight truck than a standard Btu and a combustion vehicle will provide.

So we're seeing energy demand go down, but we're also seeing more energy services as a result of those because we're switching over to more efficient fuels.

Next slide.

Okay, so the final takeaways for AATE 3. I figured we'd take a close look at some of the big picture things that we're looking at on the next couple slides here.

So transportation electrification demand overall -- and again, I apologize, I think the color here got flipped -- the highest number is AATE 3 in orange there, contrary to the legend there, but we're looking at about 64,000, I think 65,000 or so gigawatt hours of annual demand of electricity for transportation in 2035. This compares to what we have had in previous IEPR cycles, or at least in the Additional Transportation Electrification scenario that was adopted in May, seeing similar levels of demand for that. And kind of matching a shape similar to what we've already seen with the vehicles.

But, yeah, the electricity there, looking at an

annual basis, a pretty substantial increase. If we look at say 2030 to 2035, we're looking at close to -- we're actually a little bit more than a doubling of electricity demand. And so this is going to be really important for planning and something that I think we'll want to be paying close attention to.

I did see a question earlier in the chat talking about actual demand for the vehicles. We didn't present our load shapes, but when we update these slides online, we'll re-docket the new slides, but we can go ahead and put a load shape slide in there that shows what things look like on a 24-hour basis. But for now, what we're presenting here is just the annual demand.

Next slide.

And finally, I think one useful thing that we could take a close look at here would be the combustion fuels. Again, looking at quadrillion BTU in 2022, 2030, and 2035, we can see this continued decline in the AATE scenario. What we do also see is an increase in aviation combustion. So this is going to be a new target, something that we may be looking at in future work. But the non-aviation combustion, that is the light-duty vehicles and the medium- and heavy-duty trucks, we are seeing a pretty reliable decline in the use of those fuels.

And on the next slide, I just wanted to say

thanks to the entire Transportation Energy Forecasting team, Aniss, Maggie, Jesse, Elena, Bob, Liz. And Ysbrand van der Werf also helped us with our fuel price forecast. He's a little outside of the unit, but still assists us with this aspect of the forecast.

And I think from there, we can open it up to any questions.

VICE CHAIR GUNDA: Yeah, thank you, Quentin, you know, Aniss and Bob. And it's just kind of really good to hear your voices and the presentations. And I think it's so evident, the evolution of the forecast over the last, you know, several years and the focus in kind of lining up with the policy changes of California. I think it's just wonderful to see.

I have a few questions. You know, I think some are knowledgeable, but I think it will be good to have it on the record, you know, for the thinking of the team and what you're thinking over time.

So start with maybe Heidi, you know, if you're up, Heidi? Just kind of talking through, you know, I see the interest in both reducing the amount of the forecast we develop that are not necessarily useful, but then also this interest in improving our scenarios and how to better help with the policy planning going into the future. Could you just, you know, for the record, just kind of help, you

know, why we dropped the low and kind of like the high forecasts and, you know, how would we, you know, reduce the time that could be then used for scenario development and such? If you could just expand that for, you know, attendees here, that would be helpful.

MS. JAVANBAKHT: Yeah, sure. And we can touch more on this at the workshop on the 16th.

But, essentially, we just wanted to focus more of our efforts on the components of the forecast, that are producing more of the uncertainty. So the intent of the previous framework, the low, mid and high, that low, mid and high was coming from uncertainty around economic and demographic forecasts.

But really, more of the uncertainty today is coming from how we'll meet our state's goals and policies for reducing greenhouse gas emissions. And so we really wanted to free up some time to put more effort into, you know, the additional achievable scenarios that capture the uncertainty around how those policies will be implemented.

VICE CHAIR GUNDA: Yeah, that's great, Heidi. I think, you know, I want to just appreciate the work the JASC team as a whole has conducted on to investment in Our -- the additional transportation electrification scenario that was then then used for both the IRP and the transmission planning. I think it's incredible, you know?

And I think this is, more and more, you know, I think this is something that Commissioner McAllister and Commissioner Monahan say regularly, our work is becoming so integrated across the forms of energy and also the sectors. So really grateful for the vision here, so thank you to the team.

And I want to go to Aniss real quick.

Hey Aniss.

MS. BAHREINIAN: Hello.

VICE CHAIR GUNDA: Super good to see you. It's been a while.

So just on the -- kind of your slide number four, where you kind of laid out the gasoline, diesel and different fuel consumptions, I just wanted to kind of think through, I think, one of -- a visual that has been really helpful for tracking the renewable energy progression on the electricity side is kind of the joint energy landscape and how the wages (phonetic) have been changing over time, so it might be a helpful thing for us to put in. Just that's a comment.

But on the question side, specifically on the -- you mentioned that our previous bounds, upper and lower bounds, would not have really captured the prices that we've seen in the gasoline, if I understand it right, this year. And how are we thinking about capturing that

uncertainty moving forward, given the broad decarbonization goals, but also what we've heard from the petroleum workshop the last week, that moving forward, some of these changes could be a lot more lumpier than smooth? I mean, they're going to -- so how are you thinking from your vantage point and how best to capture that and the feedback loop there?

MS. BAHREINIAN: The only way to capture more of the uncertainties is having more scenarios. That's how we can capture it, I mean, given the way that we're doing, the way our models are operating.

But there are some things like, for instance, the COVID impact, nobody could predict what is going to happen, or the Ukraine war that led to the increase in prices of gas, of fuel, of crude oil, nobody could have predicted, nobody did. So there are some of these that we just can't because there are so many different factors at play that we can't do that.

But to the extent that we can capture these uncertainties, like economic uncertainties, technological uncertainties that we used to cover in the PEV scenarios, well, the way we covered it is by having more scenarios, like, as you remember in the past, we had five scenarios for PEVs versus three scenarios for everything else.

So the way we have been covering the

uncertainties in the past is by introducing more scenarios, and that seems to be the way to go in the future if there is interest in covering more of the uncertainties.

VICE CHAIR GUNDA: Alright. Thank you.

And just another question on kind of just the preferences that, you know, historically we've done the survey to help with the forecasting. Are we at a time where we are going to do another one? What's the current thinking on it? And, you know, how do you think, you know, given that we just had almost a 17.5 percent ZEV sales as a percent share, you know, and what are you looking at in terms of that?

MS. BAHREINIAN: Well, one of the things that we did extensively in this IEPR was to calibrate some of those preferences so that we can generate the same forecast that is equal to the actual ZEV numbers that we have in 2022. So we did make major changes to some of the fuel type preferences as well as others in order to calibrate the model to 22. So we are capturing that through calibrating the model to the actual data that we see on the ground.

But there are things like, for instance, autonomous vehicle is going to throw another wrench in this thing. And the way to capture that is to conduct another survey. So for the next survey that we are hoping to proceed with in 2023, we are going to place more emphasis

on autonomous vehicles because it is going to have impact, both on VMT as well as the vehicle ownership in general. It is expected that it is going to lower the vehicle ownership and it is also expected that it could increase VMT.

So we are hoping to conduct another survey in 2023. We'll see how far we can take that.

VICE CHAIR GUNDA: Very good. And let's go to my last question on this thing, just kind of thinking through the hydrogen forecast, maybe this is something that Jesse can jump in, as well, or Bob.

But, you know, we've heard from the industry in the past on the interaction between the ability to fuel and the options of fueling and, you know, the interactive effect of, you know, how much progression we are getting in the hydrogen vehicles in all classes. So just wanted to get your thoughts on, you know, what are you seeing, you know, could play out? You know, what are some of the insights from the last few years in the fuel cell vehicle industry? And how are we, again, and I think you mentioned about running different scenarios, but kind of like really looking at what are the drivers for technology selection? I think it will be a helpful insight, you know, if anybody wants to share that.

MR. GAGE: Well, speaking not just as a

forecaster but as the owner of a Hyundai Nexo, I can relate to you a lot of frustration, frankly, when it comes to the fueling infrastructure, the reliability of them. I mean, I can look over at the station availability right now and there is nothing, no stations are operating right now between here and Lake Tahoe. All three stations in Sacramento right now are dead. They have been for days. So I think that's something we really, really need to hammer on is getting these stations, the stations that we have to actually be functioning.

VICE CHAIR GUNDA: Jesse, can you just expand on that one that you mentioned, the plug-in fuel cell vehicle?

And thank you for your shout out to Sudhakar (phonetic). I did appreciate it. He kind of pounded on that one.

MR. GAGE: Yes, he did.

VICE CHAIR GUNDA: So do you think that will change the kind of interest in the fuel cell vehicles, you think?

MR. GAGE: I think it could lead to people having more options, especially if, you know, supply disruptions or -- in this manner are going to continue.

I mean, I live in an apartment myself, and an electric vehicle right now is, you know, probably unfeasible. So for me, it's hydrogen or nothing. So if

something like this can come online, if I'm still renting, then okay, I could. But if not, then, you know, I look at what I have right now and I probably had to go back to gasoline just because there's such uncertainty when it comes to fueling one of these things.

And again, this is not speaking as a forecaster, but as somebody who's driving the bus.

VICE CHAIR GUNDA: Yeah, absolutely.

Aniss, if you have anything to add?

MS. BAHREINIAN: Yeah.

And then one last question for Quentin.

MS. BAHREINIAN: I just wanted to also mention, from the model perspective and the survey perspective, one finding that is important. We, in the 2019 survey, we did a lot of work trying to determine what is the impact of fuel availability on the choice of the vehicles. And we found out, there were two factors that turned out to be statistically significant. One was time to station. It became significant for hydrogen vehicles. And then when it came to electric vehicle, having a home charger became significant for those who are buying electric vehicles.

So these two factors, in response to your question on hydrogen, that definitely turned out to be statistically significant availability of fuel for the consumers.

VICE CHAIR GUNDA: Thank you.

So Quentin, just at the top of mind, I know Commissioner McAllister might have a lot along these lines, just kind of thinking through, you know, the -- I mean, first of all, I really am enjoying the way you are framing the policy and the framework and the way we talk about the importance of bringing these different pieces together, so just appreciate that.

So as we think through, you know, whether we're looking at the, you know, the medium- and heavy-duty vehicles, and for example, this year, we had participation of, you know, some of the school buses in the federal liability services this year.

So as you kind of forecast, and as we think about the policies moving forward, given the interaction of the electric vehicles at large with the grid, whether it's managed charging, whether they're talking about V1G, V2G or really -- you know, how are you trying to provide insights into those through the forecasting products we have? I mean, do we to elevate the opportunity for V1G, V2G, and kind of like really showcase the opportunity that we should go for, given we have these billions of dollars in funding for grid reliability?

So just wanted to -- you know, you've been tracking the broad policy strokes, and I wanted to see if

there's anything that you have that you want to publicly share?

And, Bob, please feel free to jump in.

MR. GEE: Yeah, as far these broader issues around charging, especially, so as I think we've seen in the baselines and AATE, for both light-duty and medium- and heavy-duty, electricity is the dominant source of energy demand in the ZEV sector. And so we do want to think, I think, a bit more about developing -- or -- improving our load shape analysis framework in some ways, but also looking to explore some additional scenarios where we can sort of see like what's really kind of possible here.

Because one particular example would be like, if you take a look at, say, the total battery electric vehicle stock, so this is different than the plug-in hybrids on Jesse's slide, or some of these plug-in hybrids. But if you look at the battery electric vehicle stock under AATE 3, in 2030, we're looking at about 6 million of those. And just with some basic sort of back-of-the-envelope thinking, let's say each of those has 100 kilowatt hour battery, might be a little high but, you know, now we're looking at basically about -- now I'm on the spot with my math here, hold on -- I think 60 gigawatt hours of capacity -- no, no, sorry, 600 gigawatt hours of capacity, that is going to be sort of, if all these vehicles are fully charged, take a

snapshot, that's how much is sitting in their batteries.

Enabling that and seeing that as a potential pool that a little bit could be pulled out of I think is a really important thing for us to look at in terms of scenarios and opportunities.

The same goes in terms of the battery electric medium- and heavy-duty trucks. Maybe they're not as available for this purpose, but they have bigger batteries. The school bus is a pretty impressive use case. We do, I think, want to see more electric school buses than forecasted. If all the school buses were electric, it would be a huge resource, but our forecast doesn't currently show that yet.

So I think in terms of our modeling efforts, we want to, I think, develop a new sort of scenario framework. We're looking just sort of at the possibility of how these could impact the load shapes, but then also looking at the type of things that are going to enable that, which would include, you know, are the vehicles capable of doing this? So the energy might be in the batteries, but are the vehicles able to send it out of the vehicle rather than only take it in?

Then there's the charger itself. Do people have the chargers?

And then finally, I think probably one of the

more challenging roles is the interest on the part of the drivers or the vehicle owners. Do they want to participate in this? Are they going to be concerned, like do I want to hand this over, this resource over? I think it's going to need to be something that is going to be monetarily worth their while. That's where fleets might have more of an edge. But, yeah, this is one of the big things that I think we're going to be trying to gear up for.

I think, as far as the IEPR, where does it go in the planning process? I think that's a discussion we'll want to have with stakeholders. But it is something that, you know, just kind of putting it in your heads, you know, 600, 700 gigawatt hours of electric potential energy sort of just sitting there. You don't need all of it. You don't even need probably even five or ten percent of it, but that's it's a lot. So I think it's something we really want to be exploring more.

VICE CHAIR GUNDA: So I just have a comment to close on that and I'll pass it to Commissioner McAllister.

I think I agree with you 100 percent. I think what would be helpful, I mean, like the way I see forecasting is, ultimately, it's a tool for planning and policy ideation, and providing recommendations on the art of the possible and where the state has to go in terms of legislative mandates or action or funding, whatever it

might be.

So in that kind of context, I think as Heidi noted, we are kind of in a new -- we've moved away from a quasi-equilibrium mode for about a decade into this inflection point of changes; right?

So I think it would be really helpful for us to, you know, I think for the legislature and for policymakers to think about, you know, for example, today in the forecast, what part of that is ready for VG, you know, whatever V1G, V2G services; right? Is it like one percent, as you mentioned?

And similarly, as you talked about, in terms of in terms of our survey next time, it would be really helpful to get that information from the consumers on, you know, is it 10 percent of the battery that people are generally okay with letting go, but 90 percent they don't want to touch? Having that kind of information perfectly blends into the effort that, you know, Commissioner McAllister and Commissioner Monahan are trying to do in terms of LMS or charging infrastructure.

So I think it would be helpful, whether it's a roundtable kind of a staff workshop earlier, earlier, you know, in the year next year sometime to frame, you know, where we're going in the planning and what the grid should be, but what is the forecasting telling us in terms of

potential for services? And how do we help the private industry monetize, but help us, the state, with the policy?

So I look forward to it. It's a really helpful discussion if we can continue to do that.

So with that --

COMMISSIONER MCALLISTER: Great.

VICE CHAIR GUNDA: -- Commissioner McAllister, I'll pass it to you.

COMMISSIONER MCALLISTER: Well, thanks so much, Vice Chair Gunda. So you covered a lot of the topics that I was curious about, so I'll try to pick out the ones that are left.

So, first, we just wanted to say, you know, I really like -- the evolution of the transportation forecast has been just really gratifying to watch actually, you know, and it's super policy relevant now. And really this is keying off of our policy goals in sort of describing what those look like, in turn, you know, within the forecast. I think is really helpful for the reasons Vice Chair Gunda just sort of enumerated about, you know, being policy relevant and helping decisions and investments will be defined going forward, so that's great. So, you know, kudos to developing all these, all these tools that are helping provide that insight, so big progress there.

So Vice Chair Gunda sort of listed out the

reasons why, you know, this broader conversation is needed, and I completely agree. And I guess I'm, you know, maybe wondering about the ideas for kind of the platform for that discussion, you know, to get a handle on V2G, to get a sense of what distribution system investments are going to be driven by all this new load and, you know, what technologies need to be hung from the distribution grid and you know, how we need to, you know, interface, you know, with communications and controls and all that kind of stuff.

And that, you know, we think we conceive of the forecast as sort of we wrap it up in a bow and sort of toss it over the firewall over to the PUC, who then takes it and asks the utilities to design their procurement and their investments in their grid around it. But it seems like that idea to do a convening that is more iterative might be going to make sense.

And so I would definitely support that idea of bringing the agencies together to sort of drill into some of the implications of that for our specific processes. You know, maybe there's a revolution of the IRP or, you know, the distribution investment plans over the utilities that could, you know, I think, be a little more facile because things are moving, you know, more quickly than ever. So just kind of an observation.

And I was going to drill into this behavioral issue about like what consumers really want to support, you know? Because as everybody's sort of a prosumer and has, as you say, Quentin, you know, has their battery, we've always had little power plants driving around but we haven't ever connected them to the electric system; right? Well, now we actually have electric power plants already that we can connect and that's a huge potential, but a lot of uncertainty about how that actually could play out. So we definitely support the survey kind of integrating those sorts of, you know, consumer issues and behavior questions.

Let's see. I guess I'm kind of wanting to see -- just ask a methodological question. You know, so consumers have not had before, you know, this ability to switch fuels; right? It's been like, you know, they're going to do gasoline cars and so there's an elasticity associated within that, you know, gasoline car and it's very siloed; right? So, you know, people drive more or less and maybe price, you know, price has elasticity.

Is that concept kind of like -- in this context where people actually can choose to go with electric instead of gas, and they can actually cross fuel platforms, does that change the way so we can see -- is there an analytical or methodological implication of that? Like does elasticity kind of lose its meaning a little bit? Or,

you know, how are you kind of dealing with that?

You know, there's a sort of that aspect of it that you have, you know, hydrogen, you have electricity, you have gasoline and diesel, sort of apples and oranges, and we've never really thought of, you know, elasticity in that, in that way. I'm wondering if, you know, there's a methodological response to those realities?

MS. BAHREINIAN: Thank you, Commissioner.

As far as the light-duty vehicle goes, as you know, we do carry out our survey, which is quite extensive. And we do have, you know, a complicated model, too. But the benefit of our model versus all the other ones that are used by others is that you're actually accounting for the substitution between different fuel types, including gasoline. So we are not looking at them in silos, we are interacting them. So if there is price of gasoline that goes up, it's going to have impact on choice of electric vehicle and vice versa.

So the model captures, implicitly or explicitly, the substitution elasticity, the cross-price elasticity, all of those are implicitly covered in the model, in the light-duty vehicle choice model. So it is -- even though you're not explicitly using any elasticity, but the preferences that the consumers have for each of these and the input data that is used is going to account for all of

that.

COMMISSIONER MCALLISTER: So you're basically using the periodic consumer preferences survey to --

MS. BAHREINIAN: Yes.

COMMISSIONER MCALLISTER: -- kind of calibrate based on actual choices that you're seeing out there?

MS. BAHREINIAN: Exactly.

COMMISSIONER MCALLISTER: Okay. Okay, so that makes sense. It doesn't mean that that's sort of a following rather than a leading; right? I wonder if there's a way to capture that? Well, anyway, we don't need to have a detailed discussion here. But, you know, consumer preferences are changing so quickly --

MS. BAHREINIAN: Yeah.

COMMISSIONER MCALLISTER: -- it seems like it might be hard to stay ahead of that.

MS. BAHREINIAN: Exactly. Exactly. So we try using calibration to cover some of that. But the fact of the matter is that what you have mentioned, both you and Commissioner Gunda mentioned, right now, for instance, are the consumers willing to let go of 10 percent of their battery or 50 percent of their battery, et cetera? We have not asked that question in the prior surveys.

COMMISSIONER MCALLISTER: Yeah.

MS. BAHREINIAN: And we definitely, I mean, we

have asked some questions on autonomous vehicles but we didn't specifically bring it into the vehicle choice equation that we have.

COMMISSIONER MCALLISTER: Right.

MS. BAHREINIAN: So every time, with things changing, we do need a new survey to cover the new ground as well.

COMMISSIONER MCALLISTER: So maybe there's room to sort of increase the frequency of the survey to kind of keep up with all these trends?

MS. BAHREINIAN: Yes, it would be good. The survey itself takes an average of two to three years to get --

COMMISSIONER MCALLISTER: Oh, okay.

MS. BAHREINIAN: -- completed. It is actually the most complex survey that there is because of the way it is integrating both stated and revealed preferences together. And it has become more and more complex when we are asking people to respond to questions in time -- in real time, we are building choice exercises for them based on their earlier responses in real time.

COMMISSIONER MCALLISTER: Gosh.

MS. BAHREINIAN: So it doesn't even, say, take five seconds, it just smoothly goes through. But what that means is that it is quite complicated.

COMMISSIONER MCALLISTER: Okay. Interesting.

And then the last, maybe, area where it's also, you know, a place where there needs to be innovation and where we could really help inform the discussion is on rates. So as more people get on to electricity -- and maybe this is specific to electricity, you know, and sort of the elasticity discussion there -- but, you know, what -- how can our work on understanding behavior and consumer choice inform, say, rate making over at the PUC or in, you know, the POUs so that they -- you know, to help them develop the kind of EV rates or sectors, you know, customer sector-specific rates that will help move the needle here, and actually encourage people to unlock the V2G opportunity?

MS. BAHREINIAN: Sure. One of the factors that we do incorporate in the model are electricity rates. Just like gasoline --

COMMISSIONER MCALLISTER: Yeah.

MS. BAHREINIAN: -- it is incorporated into the cost per mile of the vehicle. And that cost per mile is a significant variable in the choice of the vehicles.

So we need to keep in mind that when we are talking about the survey and the model that we're building we are, essentially, talking about the choice of the vehicle, not how people are using the vehicle.

COMMISSIONER MCALLISTER: Right.

MS. BAHREINIAN: And that's -- and so we do account for the fuel prices as they are incorporated into cost per mile using, using the MPG. So the combination of the two is going to give us the cost per mile, which is one of the major -- one of the important factors in choice of the vehicles.

COMMISSIONER MCALLISTER: Well, okay. Well, I guess the reason I'm asking is more about sort of the evolution towards time of use and charging behavior, and kind of where and how that can really impact the cost per mile. Depending, you know, the same vehicle use for the same services could actually cost a lot different depending on when and where it's charged. And so those kinds of subtleties, I think, are going to be important to understand for rate making going forward.

MS. BAHREINIAN: Yeah.

COMMISSIONER MCALLISTER: You know --

MS. BAHREINIAN: Absolutely.

COMMISSIONER MCALLISTER: -- Vice Chair Gunda mentioned the LMS, you know, Load Management Standards. All this information is going to be at everyone's fingertips in an automated way, including just directly at the car so the car can make decisions about when to charge. But I think, you know, we need guidance as to how to

actually implement that sort of a regime.

MR. GEE: Yeah. I think I can speak to some of that, Commissioner McAllister.

So we do have -- we do take that annual load and we work that into hourly 8760 load shapes using our EV load --

COMMISSIONER MCALLISTER: Okay.

MR. GEE: -- infrastructure model. And that is a TOU-responsive --

COMMISSIONER MCALLISTER: Oh, it is? Okay. Good.

MR. GEE: -- model that takes into account TOU, you know, depending on which territory you're in, rates specifically in that territory, the number of EVs that anticipate in the territory, et cetera. And so that is part of it.

But you're right, there are these issues around rates that I think we can actually look into some even more interesting questions.

One interesting thing that I think has come up lately is the PUC has begun a process for electric vehicle sub-metering where the right kind of charger can actually function as a sub-meter. You don't have to drop a whole new line to a house --

COMMISSIONER MCALLISTER: Right.

MR. GEE: -- to get that meter, effective meter, and we can deal with rates in that framework or, you know, when that --

COMMISSIONER MCALLISTER: Yeah.

MR. GEE: -- works out, there would be an opportunity for that.

And I think a lot of this is kind of just speaking to the broader, you know, distributed energy resource issue, the DER kind of --

COMMISSIONER MCALLISTER: Yeah.

MR. GEE: -- discussion that you mentioned, and Vice Chair Gunda mentioned as well. And, you know, there is a proceeding where we're currently working on that and thinking about distributed -- electric vehicles as distributed energy resources. And I think modeling those in some of our scenario work, SB 100 work, I think is going to be really key to sort of showing the possibilities of what's out there so that we can begin to say, yeah, how do we manage this, this very useful resource?

COMMISSIONER MCALLISTER: Great. Well, thanks. Thanks for all those responses. Really, this is a fruitful area and very exciting.

And I would, you know, encourage, I'm sure you're already doing this, but encourage lots of interaction with the R&D and EPIC Team, because there's a lot of potential

for topics to spin over into there and for us to help find solutions where there are questions that need investment.

MR. GEE: Great.

COMMISSIONER MCALLISTER: So great. Alright.

VICE CHAIR GUNDA: Thank you.

COMMISSIONER MCALLISTER: Well, that's it for me. Thank you.

VICE CHAIR GUNDA: -- Commissioner McAllister.

And thanks, team, for, you know, patiently answering all the questions.

I just want to reiterate what Commissioner McAllister said. I think we have an incredibly smart, committed team that are really not only statewide leaders, but, you know, national and international leaders in thinking about this. And I think we have now an additional layer of task of showing our expertise, not just for the planning, because in a way, in this new phase of how do we, you know, evaluate policy elements through the forecasting and advice, but also provide recommendations as the future, you know, legislative cycles and administration thinking.

So I think you're right in the middle, you know, and you're in the middle of gas, electricity, and petroleum transition. So kudos to all the work, but also just appreciation for your commitment, and look forward to continuing this work into the next year. Thank you.

MS. JAVANBAKHT: Alright. Thanks for that great discussion.

I'm going to move us on to the public Q&A. There's a couple of questions in the Q&A chat box. And I will start with the comment and question from Diego Quevedo (phonetic). And my apologies if I'm pronouncing your name incorrectly. They say,

"I would like to mention to CEC staff that Daimler Truck has telematics data showing where diesel `vehicles stop today, along with miles traveled and dwell time. This is a great indicator for exactly -- for where exactly the kilowatt demand for ZEV medium- and heavy-duty vehicles will be located.

"Would CEC staff be open to reviewing this data?"

And Bob, do you want to take that one?

MR. MCBRIDE: Sure. That's a great opportunity. The data is quite expensive otherwise. We work with the Fuels and Transportation staff on the AB 2127, which has evolved a heavy-load model that tries to locate charging facilities. And this Daimler telematics data is exactly what they need to populate that. It's been a struggle up to this point. So we'll try and hook up with that.

Thank you, Diego. That's a great idea.

MS. JAVANBAKHT: Yeah. And, Bob, maybe you could -- well, you're retiring soon, but maybe you could

type your contact information and Quentin's contact information in the chat box for Diego to reach out to you.

MR. MCBRIDE: Sure thing.

MS. JAVANBAKHT: Okay. And then the next question, I will pass to Quentin.

So Bill Boyce says,

"I recognize that the major focus of the IEPR is on generation resource adequacy. However, has there been any discussion of adding grid distribution infrastructure expansion needs to the IEPR? Distribution infrastructure to support medium- and heavy-duty transportation electrification will be very important in supporting the state policy goals. Perhaps this is a topic that should be included in the emerging topics area."

MR. GEE: Yeah, this is a really good question. Thank you, Bill. We are currently looking to see what we can do throughout the IEPR process to get more granularity with the forecast. Currently, we distribute electricity demand into 20 different forecast zones across the state. And that level is not, as you might imagine, not necessarily ideal for distribution planning because these zones are really, really big.

Staff have begun working on products and we had our first iteration earlier this year on what we call the

load bus allocation. This is a load allocation to busbars at substations across the state. And so that, I think, will be able to provide us with some additional detail -- or IOUs, utilities, additional detail in terms of where they might be able to expect additional load associated with transportation electrification.

It is a complicated process. We're working with various stakeholders on it, including utilities, getting data from them and trying to work this around. We also are coordinating with the Public Utilities Commission.

And interestingly, the California Transportation Commission, which we haven't worked with a whole lot so much in the past, directly, at least on this issue, they're beginning a process under Senate Bill 671 to develop a report that we're going to be integrating in with our load bus allocation as well. This is currently a product that's primarily used by CAISO for transmission planning. But we do want to see how we can more fully align this with some of the work going on in the distribution planning.

MS. JAVANBAKHT: And I don't see any other questions in the chat. I will just note that there were several questions -- oh, one just came in -- there were several questions that are under the answered tab that were just answered by response in the text box.

So I'll take one more question, and then I think

we'll have to move on. So this question comes from 352 Innovation and says,

> "With several companies coming out with internal combustion engines that use hydrogen as the combustible fuel, and companies developing conversion kits to convert heavy truck diesel engines to run on all or 99 percent hydrogen as the combustible fuel, would hydrogen then be considered a combustible fuel, and or where would that usage be accounted for?"

MR. GEE: This is something that, yeah, I've been hearing a little bit about, hydrogen combustion as opposed to hydrogen for use in fuel cells. Currently, our forecast does not consider hydrogen as used in any combustion form for transportation purposes. That is something that, if we have reason to see that this is going to be a significant part of energy demand, might be useful.

I would point out that that doesn't seem to be -- I don't know exactly how it's going to align with the state goals on zero-emission vehicles. You still get things, some pollutants associated with combustion that could be problematic there, even with hydrogen.

So I think that we want to be thoughtful in how we integrate that in. But if we do find it, that would be -- we would have two categories of hydrogen, it would be hydrogen, you know, fuel cell and then hydrogen combustion

if we if we needed to make that alteration.

But I don't know. Maybe, Bob, you have something to say?

MR. MCBRIDE: Sure. We're going to have still a significant number of diesel vehicles all the way up to 2050.

Right now the issue with hydrogen is what it costs and our mid-case price forecast is not very friendly. For hydrogen, our high price case was a little more favorable. But let's say that the hydrogen fuel cell market develops and fuel is available by electrolysis, certainly at that point, it would be useful. It would help the carbon footprint to put some of the hydrogen into trucks.

But recall that so far what we have is a single demonstration in New South Wales of an engine. It's not commercialized by any stretch yet. So it's on another, you know, hydrogen combustion is on another time, you know, time ramp.

So it would be helpful. It would supplement ZEV vehicles. But it certainly would not be eligible to -- for compliance with advanced clean trucks or advanced clean sheets. But a good thing, nonetheless.

VICE CHAIR GUNDA: Heidi, before we just transition to the next one, I don't have a question, but I

just wanted to mention it. We did use in Aniss's portion of the slides GGE, and then we moved to BTU in some of the in some of the work that Quentin presented. It might be helpful to just stick to one whatever that is, maybe GGE is a better one, as we continue to talk about the gasoline equivalents, just want to throw that out there for consistency.

MS. JAVANBAKHT: Sure. Okay.

Alright, so we will move on to the next portion of our workshop this morning. And I will introduce Ingrid Neumann. She is a subject matter expert in energy efficiency and fuel substitution.

Ingrid?

MS. NEUMANN: Alright. Here I am. I had something pop up over it. So I guess we can go ahead and look at the slides. We will be speaking today about how we did some work, so we, being the Advanced Electrification Analysis Branch, on updating the additional achievable fuel substitution with the California Air Resources Board State Implementation Plan. So I will start.

We can move to the next slide, please. And the next slide.

So I'm Ingrid Neumann, as Heidi mentioned, and then Ethan will go, and then I'll wrap it up with the last little bit.

So additional achievable energy efficiency. And as of 2021, additional achievable fuel substitution, known as AAEE and AAFS, will be updated every full IEPR. So those were used from 2021. And then next year in 2023, we will do a full update again. So we've done a little bit of an interim bit here for 2022, simply because we wanted to capture a CARB's SIP Plan.

So let's move on to the next page.

So this is the new forecast framework that was shown earlier today. The load modifiers, AAEE and AAFS, are included in the planning forecast, as well as the local reliability scenario. So we have six scenarios for AAEE, the middle of them being Scenario 3 and being representative of a build a business as usual, or some reference case type forecast for energy efficiency. Similarly, for AAFS, we had five scenarios, and 3 was the mid case there or a business as usual case. So those two are the ones that are used for the planning forecast. And those are the same additions as were developed in 2021 and further documented in the IEPR Volume IV, which I've noted below. There's a link there that you can find some more details on what went into those forecasts.

So then the local reliability scenario is designed to be a little bit more conservative, so to further account for uncertainties and be very conservative

in the electricity planning at the local level. So that's why we used lower energy efficiency in that scenario. So we used AAEE Scenario 2, . And we used higher fuel substitution, or building electrification impacts, so AAFS Scenario 4, in that local reliability scenario, because including slightly higher electrification forecasts would provide a more conservative electricity forecast.

So let's move on to the next slide.

I want to give a high level overview. Of course, for the details, you can refer to last year's IEPR of what went into these AAEE scenarios. As I mentioned, there are six of them. Two of them here in yellow are used for the planning forecast, Scenario 3, and the local reliability forecast, Scenario 2. The four main data streams are the IOU potential program savings, then the POU potential program savings, codes and standards, which include California specific Title 24 Building Standards, as well as Title 20 Appliance Standards, as well as the Federal Appliance Standards.

Now the Beyond Utility Program savings is a catchall bucket of about 40 or so workbooks at this point that capture all sorts of other energy efficiency programs running in the state of California.

Moving on to the next slide, please.

So we did something similar for the AAFS. These

are the programmatic contributions for fuel substitution or building electrification. We have the same types of data stream, right, with the IOU and POU potential programs. And then Title 24 did have some electrification focused compliance paths that were included here in AAFS in 2021. And there were about seven or eight workbooks here for the Beyond Utility program impacts.

The mid mid-plus Scenario 4 was chosen for the local reliability scenario, right, because we wanted to look at a more conservative electricity planning scenario there, whereas the business as usual or reference case remained the Scenario 3. So that's why we lined those up in the way that we did. So there were five scenarios, but it's not one through five, but rather two through six, so that the three would always be the mid-mid.

Next slide, please.

So this gives you an idea of the spread of those scenarios; right? For the more aggressive energy efficiency or fuel substitution scenarios, we really are putting a lot of hypothetical programs that are still under development that could be developed, and so on, in there. And then the conservative ones, we're really not including anything that hasn't been planned out and very well-quantified already.

So you can see the two columns for electricity

and gas savings on the left-hand side for the AAEE, and the two charts on the right-hand column for AAFS, also for electricity and gas. And in green on those are the planning forecast components, so sort of our business as usual. And in blue are the more conservative components of the local reliability scenario. So those really are the middle cases, not the aspirational or more optimistic cases we might use for some policy analysis.

So while AAEE reduces electricity consumption, AAFS will add an incremental amount of electricity because with any type of building electrification we are displacing gas but then must still provide to the end user and that does involve, even with an efficient technology, some incremental added electricity. Of course both AAEE and AAFS reduce gas consumption.

Next slide.

So then we get to what's really new for 2022 here for this update in which we would normally not do any scenario updates. But what we didn't include in AAFS was the recently adopted CARB State Implementation Plan. So that includes some requirements on zero-emission space and water heating equipment sales after 2030. And we added this modeling to AAFS Scenario 4 the 2022 update. And Ethan Cooper will explain that work in detail.

MR. COPPER: Alright. Sorry. Hello. My name is

Ethan Cooper and today I'm going to be going over the FSSAT modeling results that we have for the zero-emission space and water heater measure that is part of the California Air Resources Board's 2022 State SIP Strategy. Next slide, please.

So, a little bit of background for the 2022 State SIP Strategy. I want to bring up one of the proposed measures within it which states that beginning in 2030, 100 percent of new space and water heaters for either new construction or existing buildings sold within California would need to meet the zero-emission standard. This measure was adopted within the 2022 State SIP Strategy by CARB last September. The rulemaking process for this measure, such as workshops, is expected to begin in 2023. And the Regulatory Board hearing is expected to happen in 2025 for this measure.

Next slide, please. Thanks.

Alright, taking another look at the new forecast framework, for the 2022 IEPR Demand Forecast Update, we are having the CARB SIP Strategy, in particular the zero-emission space and water heating measure, be included in the local reliability scenario, as we show by the red circle at the very bottom right-hand corner of the table here on the slide.

For modeling the SIP Strategy, we use the fuel

substitution scenario analysis tool, or FSSAT, to try to get an estimate of the energy impacts from the SIP Strategy so that way we can have that be a load modifier that gets applied to the baseline demand forecast. So the energy impacts for the zero-emission space and water heater measure are going to be coming in the local reliability scenario, alongside the energy impacts for AAEE Scenario 2, AAFS Scenario 4, and AATE Scenario 3, as you can see by the very far right column on the table on the slide.

Another thing to note here is that the impacts from the SIP Strategy are going to be layered on top of the energy impacts from AAFS Scenario 4.

Next slide, please. Okay.

As mentioned previously in the last slide, we used the FSSAT tool to model the energy impacts of the zero-emission space and water heater measure. Previously, FSSAT has been used for the AB 3232 California Building Decarbonization Assessment, which was adopted in 2021, and for the Demand Scenarios Project, which was adopted earlier this year.

FSSAT is classified by us as a what-if policy analysis tool, which we use to try to examine the cost, energy, and emission impacts for various fuel substitution scenarios, each with their own levels of AAEE and AAFS assumptions.

One thing to note here is that for the 2022 SIP Strategy by CARB, we are going to continue to use some of the same efficiency and technology set assumptions, which we used for the AB 3232 California Building Decarbonization Assessment and the Demand Scenarios Project. These assumptions are important for us to know because they let us understand what electric technologies we have to replace gas equipment with and how we view high versus low efficiency appliances.

So looking at the technology sets for the SIP Strategy, we're going to be having a variety of heat pump technologies available with each having their own degree of efficiency to replace gas equipment for the HVAC end use, and for the water heating end use, we're going to have a variety of heat pump and electric resistance technologies as eligible replacements for gas equipment.

Next slide, please.

Alright, so for the characterization of the 2022 SIP Strategy, the three bullet points below here represent some of the assumptions we made in FSSAT for the local reliability scenario.

First, we're using the 2021 IEPR natural gas forecast to provide us with a baseline of natural gases available for either programmatic or FSSAT fuel substitution and for programmatic energy efficiency.

Next, looking at the programmatic activities, we are using AAEE Scenario 4 to provide us with the programmatic impacts of fuel substitution measures from 2022 to 2035. We're also using AAEE Scenario 2 to provide us with the programmatic impacts of electric and gas energy efficiency measures for 2022 to 2035.

Third, when looking closer at the 2022 State SIP Strategy, CEC staff worked in consultation with CARB staff to produce the following electric appliance adoption assumptions within FSSAT that are used for the residential and commercial sectors.

One other thing to note here is that for the energy results for the SIP Strategy, these are incremental to any of the results that come from the existing programmatic activities that I mentioned above, so for either AAFS or AAEE.

Now looking at the bottom table here for the electric replacement assumptions that are made for residential and commercial HVAC and water heating electric appliances, we're first looking at the new construction buildings in all local air districts. Looking here, we see that we have zero percent adoption of electric appliances from 2020 to 2025, with that adoption increasing to 100 percent starting at 2026 and staying there for the rest of the forecast.

For existing buildings in all Air Districts besides the Bay Area Air Quality Management District, or BAAQMD, we again see zero percent adoption of electric appliances from 2020 to 2025. But now in 2026, we see that there's 20 percent adoption of electric appliances to replace burned-out gas equipment, with that percentage increasing by 20 percent each year until 2030 where we reach 100 percent adoption of electric appliances to replace gas equipment.

For existing buildings in just the Bay Area AQMD, we again see zero percent adoption of electric appliances from 2020 to 2025. Now in 2026, we see that there's 25 percent adoption of electric appliances to replace burned-out gas equipment, with that percentage going up by 25 percent each year until 2029 where we reach 100 percent adoption of electric appliances replacing gas equipment in that year.

Next slide, please.

Alright, here's a first look at our natural gas results for the SIP Strategy. So, looking at 2035, we were able to determine that the SIP Strategy (referred to as FSSAT savings in the following charts) provided around 2,500 mm therms of gas savings. This is about twice the amount of gas savings that we saw from the combination of AAEE Scenario 2 and AAFS Scenario 4 combined, and was more

than twice the amount of savings seen from just AAFS Scenario 4 alone.

In splitting up these savings by either new construction building savings or existing building savings, we notice that AAFS provided the most fuel substitution gas savings for new construction buildings, while FSSAT provided the most gas savings for existing buildings.

Next slide, please.

Alright, so the following graph on this slide and the next two slides gives us a look at what the energy impact is of the AAEE, AAFS, and FSSAT load modifiers to our baseline demand forecast for existing buildings.

So first on this slide, looking at the brown line, we can see what our baseline natural gas forecast is for existing buildings. And then below that, the green line shows us what our modified baseline forecast is for existing buildings. And this green line represents the baseline forecast after we have AAFS Scenario 4 energy impacts applied to it. So, the difference between the brown and the green line here, which is represented by the green arrow, just shows us the energy impacts or the natural gas savings that occur from programmatic AAFS Scenario 4. Another thing to note here is that the green line also represents the amount of natural gas that we have available for FSSAT modeled fuel substitution.

So, in this case, the green line represents the amount of natural gas that we have available for fuel substitution that's going to be occurring from the 2022 SIP Strategy.

Next slide, please. Thank you.

Alright, now looking at the blue line here, this gives us our revised baseline natural gas forecast for the existing buildings. And this represents the baseline forecast after we have programmatic AAFS Scenario 4 and FSSAT natural gas savings applied to it. So, the difference between the green and the blue line here, represented by our blue arrow, gives us the energy impact or the natural gas savings that are seen from the SIP Strategy as we are modeling it in FSSAT.

Next slide, please. Thank you.

Alright, and the final line here, this orange line, is our final natural gas forecast for existing buildings. And this line represents the baseline forecast after we have all of our load modifiers applied to it, so AAEE Scenario 2, AAFS Scenario 4, and the FSSAT savings. And the difference between this blue and orange line here, which is represented by our orange arrow, basically just shows us the energy impacts or natural gas savings that occur from programmatic AAEE Scenario 2.

So looking at the final graph here, we can see a clear picture just of how the SIP Strategy, as we were

modeling it in FSSAT, will have the greatest energy impact, or in this case, natural gas reductions, for existing buildings. And we can see here that the reductions from just the SIP Strategy are more than even the combination of AAFS and AAEE for existing buildings. Next slide, please. Thank you.

Alright, now taking a look at our natural gas savings split by sector, we have the graph on the bottom of this slide showing us the residential sector, represented by green , low-income sector, represented by orange, and the commercial sector, represented by blue.

So looking here at the graph, we can see that the commercial sector has the lowest amount of savings being seen there, followed next by the low-income sector, and then finally the residential sector has the most amount of gas savings being seen. And I think the primary reason for this is just because of how much natural gas is available for fuel substitution in the green portion, the residential sector, when compared to either the low-income or commercial sector.

Taking a look at our results for 2035, we saw that for the residential sector, we saved around 1,200 mm therms of natural gas. As then for the low-income and commercial sectors, we saved around 720 mm therms, and about 560 mm therms for the low-income and commercial

sectors, respectively.

Next slide, please.

Alright, now taking a look at the electricity system impacts, we're able to see that by 2035 the SIP Strategy added around 24,000 gigawatt hours of electricity. And one thing to note here is that this amount of electricity is about three times greater than what we saw added from just AAFS Scenario 4 alone in 2035. There are two main reasons why they're so different, the savings from AAFS versus the SIP Strategy.

The first reason is, as we saw in the previous slides, because of the fact that the SIP Strategy actually saved more natural gas by 2035 than AAFS Scenario 4 did. It saved about two times as much natural gas.

The second is because of the fact that we have a variety of eligible replacement technologies that are characterized in FSSAT, with this also being the fact that we have both heat pumps and electric resistance technologies that are available to replace gas water heaters.

Another thing is also the fact that each of these technologies have their own levels of efficiency. So, some technologies being put in to replace gas equipment might use more electricity than another would.

So now then, splitting up the electricity savings

for all of our three load modifiers by either existing buildings or new construction, we can see in the charts below that the blue color portion of each column represents FSSAT add electricity, the green color portion represents the AAFS add electricity, and the orange color portion represents the AAEE electricity savings. And the reason why those are negative is because we're saving electricity for AAEE while we're adding electricity for FSSAT at AAFS.

So first looking at the left chart, the new construction added electricity in gigawatt hours, we can see that AAFS Scenario 4 adds the most electricity for new construction buildings, which matches what we saw for the natural gas savings seen from AAFS versus FSSAT for new construction buildings.

However, on the right chart, the existing buildings added electricity in gigawatt hours chart, we can see that FSSAT is adding the most electricity to the grid, considerably far more than we see for AAFS by 2035. So this matches with what we previously saw when looking at the demand reduction impacts of FSSAT to the baseline forecast versus the impacts that AAFS had for existing buildings. So overall, for the fuel substitution related added electricity, the 2022 SIP Strategy appears to have the greatest grid impact for existing buildings while AAFS continues to have the

greatest impact for new construction buildings.

Next slide, please.

Alright, looking at our electricity system impacts split by sector, we can again see from the chart on the bottom of the screen that the green portion of the chart represents the residential sector, the orange part represents the low income sector, and the blue part represents the commercial sector.

So, looking here, we can see that, once again, the residential sector is adding the most electricity out of the three different sectors that we model in FSSAT, followed next by the low-income sector, and then finally the commercial sector. And again, this makes sense with how much natural gas is available to fuel substitute for the residential sector when compared to either the low-income or commercial sector.

Looking now at the results in 2035 for added electricity, we saw that the residential sector added around 12,700 gigawatt hours of electricity, while the low-income sector and the commercial sector added around 7,300 gigawatt hours, and about 4,100 gigawatt hours of electricity, respectively.

Next slide, please. All Right. I think this is the last slide.

So, in preparation for the 2023 IEPR, CEC staff

are planning to work in consultation with CARB to perform more modeling and technology assumption updates to the FSSAT tool. Another particular interest that staff has is to also improve the FSSAT tool's low-income household modeling capabilities.

Next slide, please.

That is all for me. I'm going to hand it back over to Ingrid. Thank you all.

MS. NEUMANN: All right. Okay. So I'm just going to go ahead and wrap it up as far as what AAEE and AAFS now look like.

We've modified the AAFS for 2022 and -- because sometimes people look at these separately, and these are the load modifiers to be layered on top of the baseline forecast in much the way that Ethan showed already.

So next slide, please.

Alright, so this is where we were here for the planning forecast. We have the AAEE Scenario 3, AAFS Scenario 3. This is unchanged from what existed in 2021 for a planning forecast or the statewide type of activities. So you can see here in the lighter green, the AAEE gigawatt hours on the left, mm therms on the right, in the darker green, the AAFS Scenario 3, gigawatt hours added. And then on the right-hand side, the gas saved. Of course, both AAEE and AAFS reduce gas consumption

statewide. So it's always easy to say that combining those will always decrease gas consumption from the baseline forecast.

Then on the electricity side, things can get a little bit more tricky. Here we do have AAEE three reducing the electricity consumption enough so that AAFS 3 adds an incremental amount, but that amount is relatively small. So the overall combined electricity consumption of these two load modifiers often used together is still reducing the consumption of the baseline forecast.

So let's move to the next slide.

So this is where we see a change in the local reliability scenario where we've added the SIP plan, so the CARB State Implementation Plan that Ethan just went over. The AAEE 2 includes less energy efficiency, so less electricity savings as well as gas savings in the bright blue, whereas AAFS 4 plus SIP now includes a lot more electricity added just because this is a very wide-reaching policy. So we have a lot of gas being displaced. But, of course, we still need to provide service for those end users. So there is incremental electricity added and a lot more of that than the small amount of energy efficiency that we have in the more conservative AAEE two case.

So yes, gas consumption is still reduced statewide, but here we reach that point where the overall

combined electricity consumption in the left-hand graph in black crosses that axis and you actually have increased electricity consumption after 2020. And this is including the particular assumptions that we had then. It would depend on how this might ramp up and exactly how the CARB regulation is implemented once the rulemaking process there has been completed.

So that concludes our presentation and we have a final slide, which includes the contact information for the team that worked on this. So Ethan, myself, and of course, Nicholas Janusch, who is not presenting today, but had no small part in this.

VICE CHAIR GUNDA: Awesome. I just first want to say kudos to you and Nick, and Ethan, who I haven't met yet, but a wonderful presentation, Ethan, by you, very clear, substantive.

You know, I've taken a lot of time on the previous one, so given Commissioner McAllister's leadership on the buildings, I'll ask him for questions first and then I'll come back.

COMMISSIONER MCALLISTER: Well, thanks, Vice Chair Gunda, and Ingrid and Ethan and Nick, Nick Janusch. behind the scenes, I know, doing a lot of work with FSAT. So all three of you as a team, just great work.

You know, I think the -- I don’t have anything

that's counterintuitive on what you've shown. It makes sense to me. And, you know, I'm really glad that we've taken the even year to think and, you know, incorporate new developments into our strategy and our methodology so we can sort of do that, you know, starting off running next year in the full forecast, so that's great.

I guess, you know, I would just make a point of highlighting, and Ingrid, you suggested this, you know, this SIP Strategy, the adopted State Implementation Plan, which has a basis in the Clean Air Act, right, and therefore runs through the Air Resources Board's authority, is an incredibly wide-ranging effort. It really is, you know? It's a scale that's really different from anything that we can cover, say, in the new construction realm with the building code.

And the ARB, in the Scoping Plan that's in its final draft out for circulation now, is proposing to take that approach even further to additional combustion devices and essentially eliminate those from the marketplace and the residential sector by 2035. And so we will need to update our forecast, our AAFS, with that when that becomes finalized, if it stays in its current form, certainly.

And so maybe I'll just provide just some context for folks who are listening in because, you know, the forecast and the Building Standards kind of -- and building

electrification aren't necessarily the same set of stakeholders. But we do a lot in the Building Code which sort of, by its nature, focuses more on new construction. And you saw in the slides here that new construction is a relatively small part of the forecast in terms of the actual energy consumption that it implies, you know, over the forecast period.

Really, the big kahuna is the existing buildings. And the energy consumption is there, and therefore, to reach our climate goals, the movement in the marketplace and the fuel substitution from gas to electricity or from, at least from fossil gas to other alternatives, the bulk of the action has to be there.

And so the ARB's effort on the State Implementation Program really begins to grapple with that larger question of moving our existing buildings, and it's a big deal. Our authority in the Building Code doesn't really allow us to, at least not easily, to ban gas or to require that electric and uses be installed in all cases in new construction.

And so we've actually formed a partnership over the past few years with the ARB to ensure that our respective authorities are used in ways that are complementary. And so when you come at -- so what we've done is sort of stack the deck, you know, in the Building

Code, we've sort of made it by ratcheting up the energy efficiency, ratcheting down the energy budget for new construction, we've made it very difficult to install less efficient technologies. And among those less efficient technologies are gas combustion appliances.

So it makes it difficult to put in gas combustion appliances, but not impossible. You know, the federal government has a say in what heating and uses are allowable in the states. And so we can't just, you know, make this unilateral decision

to -- through an energy code to get rid of gas and uses.

Air quality is a different story. The ARB actually does have a very deep authority in its State Implementation Plan to do what's necessary to get NOx reductions and get particulate reductions.

And so anyway, that's the driver and, I think, really, the lever, the jurisdictional lever that's going to allow us to move the marketplace to not emitting to zero-emission technologies.

Anyway, this is maybe known to many people on the call, but I think the context is important that going forward, these load modifiers are really going to depend on muscular policy, both at the Energy Commission and the Air Resources Board working together. And so I just want to just give kudos to staff for collaborating, for being so

quick in incorporating the SIP into this analysis, and for collaborating with the ARB and really understanding having that back and forth so that we understand how to utilize and apply our authorities in complementary ways. And much more of that to come in the scoping plan and the implementation of the scoping plan.

But it's gratifying for me to see this playing out in these load modifiers, because I think those really are going to be where much of the action is going forward. As we invest, you know, a billion and a half dollars in equitable building decarbonization, we need to make sure that the technologies we're incentivizing comport with state policy, comport with getting to the zero-emissions goals, moving the marketplace to make those end uses feasible, cost effective, and really doable in real life by Californians across the state.

And so, and if we do that, we're going to get these results that you're now modeling. And so, you know, that back and forth and that just understanding of what our policy, the implications of different policy levers are really great to have.

So anyway, that's my kind of contextual soliloquy here. Really, all this is to say that I think you've hit the nail on the head with reflecting current -- sort of the policy direction of not just the Energy Commission but

across the state in your assessment of the load modifiers. So thanks a lot for that.

I don't have any further questions.

VICE CHAIR GUNDA: Thank you, Commissioner McAllister. I really appreciate you kind of laying that perspective.

I have a couple of quick questions. One is more of a clarification and the other one is a little deliberative, you know, given we have a few minutes to think through this a little bit.

You know, the first one actually kind of coincides with somebody else who mentioned this.

In terms of, specifically, Ethan, the work that you presented, could you talk through how you're avoiding double counting in any of those? I think that will be helpful to just talk through.

MR. COPPER: yeah. So, I think, to avoid the double counting, we have AAFS run through the tool first, so that way what we get stuck with after that is our modified baseline forecast, and that's the only amount of natural gas we have available for FSAT to model fuel substitution. So, basically, we make sure that AAFS is done first and all those savings are accounted for, and then anything else that's over can be modeled for fuel substitution in FSAT. So that's kind of how we account for

the double counting of AAFS.

VICE CHAIR GUNDA: Alright. Thank you. That's helpful.

So I think, Ingrid, to this, to you and maybe the broader team, and I'm going to just look into the slide, you know, specifically the slide 23, you know, like the local reliability element. So what I kind of want to think through here is the name of -- I mean, what we're striving for is acceleration towards the policy goals of California. So we, you know, we as a team have, you know, the important like kind of role of understanding what that means to planning assumptions; right? But the other counterweight here, we have started observing in the electricity side, is affordability and reliability, right, meaning, yeah, I know, on one end, if you're going to project higher levels of electricity usage, given that it's growing, it's helpful from a policy standpoint to build faster, you know, so that we can cover, you know, the upper end of the situation of electrification; right?

On the other side, when we talk about gas, and if we lose a certain level of demand, you know, my question is, when we construct for the local planning, how does that impact reliability; right? So if the lower ends of what we're expecting is not what's happening, and if a higher demand were to show up, you know, how do we think through

that; right?

So we want to be -- I mean, we're right now going through that inflection where we want to cover as much broad level as possible at both ends. So wanted to get your thoughts on, you know, given your discussion with PUC, you know, other utilities and such, have you heard that concern? What are you thinking through in terms of long-term usage of this analysis?

MS. NEUMANN: Well, I think that's the question; right? That's why we wanted to include it and not wait until 2023; right?

So right now, yes, CARB adopted it, so something will happen. What exactly that will look like, will it be pushed out a few years, could it be accelerated, would, you know, would different sectors be treated differently, would there be a way found to eliminate electric resistance technologies, so that you would only have efficient technologies, things like that, we don't know; right?

So what we can see from this is that at some point -- and, you know, we did collaborate, I mean, Ethan and Nick especially collaborated with CARB trying to figure out what type of ramp up might be reasonable, right, because you're not going to go from zero to 100 percent sales, you know, in a specific year. So based off of that, you know, we could see, well, these impacts are pretty

significant; right? We're doing three times as much than we would with the programmatic impact; right? Where the programmatic impacts would, of course, be looking only at efficient technologies and so on, right, but they're just not as widespread.

So that's why we wanted to include it here for the local reliability scenario, because if in the way it's presented here, it certainly would have consequences. What exactly those consequences are, we would probably want to hear from stakeholders. So that's why we wanted to put this modeling out in one form so that we can hear how stakeholders might use it, what kind of impacts it might have for their planning processes. And then, of course, as all of the regulatory work that CARB is doing, you know, from 2023 through 2025, develops, we'll follow that, adjust our modeling, and, you know, just always improve it. And hopefully -- I mean, the idea is you don't want to be surprised with some sort of electricity need that you weren't anticipating at all, so --

VICE CHAIR GUNDA: Exactly. So I think Mike Jaske has his hand up, and he's on the attending list. I don't know if, you know, the IEPR Team can just promote him to be able to add to it.

MR. JASKE: So clarification of your original question, Vice Chair Gunda. Were you asking about gas

reliability or electric reliability?

VICE CHAIR GUNDA: I was thinking about gas reliability. Like, you know, if we over project, you know, I mean, we anticipate high levels of production, which we want for our climate goals, but if that were not to manifest, and if our planning of the gas system is a lot more optimistic in terms of the reductions, you know, how do we balance that for local reliability, especially; right?

So on the electric side now, the policy scenarios are helping us think through higher levels of electrification, and how do we take care of that. On the gas side, it's like the opposite. And how do you kind of think through a reasonable level of planning while also understanding the policy implications? So just wanted to get your thoughts on that too.

MR. JASKE: Well, I think that since for all existing gas customers, there is a distribution infrastructure in place, and for future development, where natural gas will not be provided to a business or residents, there won't be a gas infrastructure, so it's confined to existing customers. And it's a question of not the physical infrastructure, but the procurement of gas. And, you know, albeit most of the gas used in California comes from faraway places, Canada or the Southwest, but

that infrastructure is still in place, the physical infrastructure.

So I think there is a question there in very large reduction conditions, so maybe quite far out, you know, 2040 or something beyond that, where is the gas industry so affected by what California and other jurisdictions are doing that there is actually a gas production problem or a mismatch? That's not the domain of our Demand Analysis Group, and so we would need to bring other expertise in the Commission into a picture of answering your question.

VICE CHAIR GUNDA: Great, Mike. So just again, continuing on that, that process just for another minute here, so I think what I'm kind of thinking through, you know, Mike, I think we had these discussions prior, especially looking at the totality of the energy system in California, and then the CEC's unique role of thinking through long-term trends and providing direction, I think it would be helpful to continue to think about the evolution of the system as a whole and how our analytical pieces could identify potential issues that we need to manage.

And I think that would be, one of those things is, you know, given the residential component of our residential and commercial component and gas usage versus

the natural gas generation and how all those things are collectively being impacted at the same time, it would be helpful to understand the totality and how do we flag any concerns we might have as a team moving forward. So that's kind of like where my brain was.

MR. JASKE: Important questions that we don't have answers for today.

VICE CHAIR GUNDA: Thank you. But I just want to appreciate, Mike, to you, Ingrid, Ethan, and Nick Janusch, everybody who has really moved the ball on this whole work, analytical work over the last couple of years, and also Ida, I know she has an important role to manage stuff. So thank you all for that excellent work that you've been doing.

The more questions means it's exciting. So many more possibilities to ask and open up, so thank you.

With that, I'll pass it to Heidi.

MS. JAVANBAKHT: And before I jump into the Q&A, I also just wanted to echo, and Ben mentioned this in the opening remarks, but express our appreciation for CARB's collaboration on both of these pieces that we presented on today, the transportation, the AATE forecast, and then also this SIP measure. They provided a lot of data and input and advice on how to go about modeling these.

So we have one question in the Q&A, which may be

for Ingrid.

"What are the current and some potential and some potential uses for AAEE and AAFS scenarios that are more aggressive? So in particular, Scenarios 4 through 6 and AAFS Scenarios 5 and 6."

MS. NEUMANN: Yeah, so we develop more aggressive scenarios that include, you know, speculative programs. So maybe something someone is thinking about or an agency is thinking about or some that might be in a planning stage, you know, but they might not be funded or the funding's uncertain or, you know, that sort of thing. So then we would calculate some sort of technical potential there based on what that program could look like. And we, of course, wouldn't want to include that in the planning forecast or local reliability because it's not something that is really at all certain; right? So it's just much, much more uncertain.

And so what that then means is we can use this for some sort of analysis as far as how much more energy efficiency could we have, right, if we had the funding and the effort spent on doing this? So this could tell us how close we can get to meeting SB350 goals. So that was the energy efficiency doubling goal that was set in 2015. So we could look at, you know, how much more energy efficiency would we need, how much more efficient electrification

could qualify towards SB350 and that sort of thing.

Similarly, what we did early this year is we started, so Anitha Rednam and Mike Jaske spearheaded this, we had the demand scenarios which looked at what kind of statewide GHG goals were we meeting; right? What kind of huge policy goals, like how far are we on track to meeting those? What more do we need to do; right? So what more can be done with energy efficiency, what more can be done with fuel substitution is what we're attempting to reflect in those more aggressive scenarios.

MS. JAVANBAKHT: Thanks, Ingrid.

And that's it for the Q&A.

Stephanie?

MS. BAILEY: Thanks, Heidi.

So I guess now it's time for us to move to our public comment period. One person per organization may comment and comments are limited to three minutes per speaker. So for the Zoom platform, you can use the raise-hand feature to let us know that you'd like to comment and we will call on you and open your line to make those comments. I am not seeing any at the moment. We'll give it just a moment in case anybody is wanting to make a comment today.

Seeing none, I guess we will turn it back over to Vice Chair Gunter for any closing remarks.

VICE CHAIR GUNDA: Thank you, Stephanie.

Again, thanks to the team for the wonderful work. I'm just really, really thankful and excited about, you know, the work, the trajectory, the vision. You know, Heidi, you and before you, Matt, who was all brought into this and all the coordination we do with the JASC team in terms of CAISO, CPUC and CARB. And kudos to Simon Baker, Delphine for their contributions on so many different fronts from the other agencies. So thank you for all the work. Look forward to the second half of this on December 16th.

I don't have anything other than gratitude today.

So with that, Commissioner McAllister, do you want to say anything or jump off?

COMMISSIONER MCALLISTER: Just would just reiterate that gratitude, I mean, really great work. And you know, it's the formal products that we produce and everything, but it's also just the knowledge that we generate and the insights that our staff has as a collective that are just invaluable for the state, such an amazing resource. So thanks everybody for all the hard work and keeping their sleeves rolled up and your collaboration. The posture is just wonderful, so thank you.

VICE CHAIR GUNDA: Yeah, so in terms of next

steps on comments and such, you know, Stephanie, do you want to -- or, Rachel, do you want to talk to them?

MS. BAILEY: Sure.

VICE CHAIR GUNDA: I'm sorry. Go ahead.

MS. BAILEY: Yes. Public comments are due December 21st for this workshop and we will have a part two on the 16th.

Thank you, Stephanie. Thank you, IEPR team. With that, adjourned. Thank you.

(The workshop adjourned at 12:35 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.

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

IN WITNESS WHEREOF, I have hereunto set my hand this 13th day of January, 2023.

MARTHA L. NELSON, CERT**367

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January 13, 2023