DOCKETED

Docket Number:	15-IEPR-10
Project Title:	Transportation
TN #:	205367
Document Title:	Transcript of the June 24, 2015 Workshop on the Preliminary Transportation Energy Demand Forecasts
Description:	N/A
Filer:	Cody Goldthrite
Organization:	California Energy Commission
Submitter Role:	Commission Staff
Submission Date:	7/16/2015 1:34:41 PM
Docketed Date:	7/16/2015

COMMITTEE HEARING

BEFORE THE

ENERGY RESOURCES CONSERVATION AND DEVELOPMENT

COMMISSION OF THE STATE OF CALIFORNIA

In the matter of,	)	
	)	Docket No. 15-IEPR-10
	)	
Integrated Energy Policy	)	
Report (2015 IEPR)	)	

PRELIMINARY TRANSPORTATION ENERGY DEMAND FORECASTS

CALIFORNIA ENERGY COMMISSION

FIRST FLOOR, ART ROSENFELD HEARING ROOM

1516 NINTH STREET

SACRAMENTO, CALIFORNIA

WEDNESDAY, JUNE 24, 2015

9:04 A.M.

Reported By:
Peter Petty

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Robert Weisenmiller, Chair, CEC

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CEC Staff Present

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Gene Strecker

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Ysbrand van der Werf

Jesse Gage

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Public Comment

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Miles Heller, Tesoro

Tim Tutt, Sacramento Municipal Utilities District (SMUD)

Eric Seilo, Pacific Gas & Electric Company (PG&E)

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P R O C E E D I N G S

JUNE 24, 2015 9:04 A.M.

MS. RAITT: Welcome to today's IEPR Commissioner Workshop on the Preliminary Transportation Energy Demand Forecasts.

I'm Heather Raitt, the Program Manager for IEPR. I'll go over the usual housekeeping items. Restrooms are in the atrium, a snack bar is on the second floor.

If there's an emergency and we need to evacuate the building, please follow the staff to Roosevelt Park, which is across the street, diagonal to the building.

Today's workshop is being broadcast through our WebEx conferencing system. And parties should know you're being recorded. We'll post an audio recording on the Energy Commission's website in a couple of days and a written transcript in about a month.

At the end of the day there will be an opportunity for public comments. We're asking parties to limit their comments to three minutes.

For those in the room who would like to make comments, please fill out a blue card and give it to me. When it's your turn to speak, please come to the center podium and speak into the microphone. It's also helpful to give the court reporter your business card.

For WebEx participants, you can use the chat

function to tell our WebEx coordinator that you'd like to make a comment during the public comment period and we'll either relay your comment, or open the line at the appropriate time.

For phone-in-only participants, we'll open your lines after hearing from in-person and WebEx commenters.

If you haven't already, please sign in at the entrance of the hearing room. Materials for this meeting are available on the website and hardcopies are available on the table at the entrance.

Written comments are welcome and due on July 8th. The notice provides an explanation for how to submit written comments.

And with that, I'll turn it over to Commissioner McAllister.

COMMISSIONER MC ALLISTER: Okay. Well, thanks everybody for coming. I'm very happy to share the dais with my fellow Commissioners, Chair Weisenmiller and Commissioner Scott. Commissioner Scott being the lead on transportation. So, we have the right ears in the room here at the Commissioner level and, really, thank everybody for coming.

And those who are going to present, as well, and again IEPR staff for putting the workshop together.

I'll be really brief in my opening comments. I

just want to highlight the fact that transportation is a hugely important sector for our overall energy goals and, certainly, our carbon goals.

There's incredible technology innovation going on, on a bunch of fronts in the transportation sector. And there's also, actually, increasingly a lot of behavior related work and, you know, urban growth that's all related. Right, vehicles miles traveled and technology, and how people live their lives and how the economy runs with the freight and goods movement, and et cetera.

So, there are a lot of variables in this. And I think it's very challenging to look past kind of the ends of our noses and figure out what even next year looks like, not to mention a decade away.

So, the modeling challenges here I think are very formidable. And we are -- I think staff is doing a good job digging into the details, and scenarios, and working with the other agencies, particularly ARB, to get a handle on all the issues at each step. Because, you know, the moving, shifting sands, the moving ground and all that stuff.

So, I think we're doing the right things and really trying to get a handle on what is a quite complex arena. And I'm looking forward to seeing this iteration

and hearing from all the presenters today. And, certainly, this will be a nice, another kind of step forward in the road towards clean transportation and clean energy systems.

So, I'm very happy to be sharing this staff day with all of you. And I'll pass the dais to Commissioner Scott.

COMMISSIONER SCOTT: Well, good morning everyone. Thank you so much for joining us. I will underscore what Commissioner McAllister said, so I won't repeat too much of that.

But when I think about the transportation sector and what a critical component it is to the energy goals that the State has, the climate change goals that we're working to meet, the clean air goals that we're working so hard to meet in the San Joaquin Valley, and the South Coast, and others the transformation of the transportation system to cleaner fuels and cleaner technologies is really a critical component of that.

And so, I'm very interested to see what the energy demand, transportation energy demand forecasts look like, and look forward to our discussion today.

CHAIR WEISENMILLER: Yeah, I also want to thank folks for their participation today. I really appreciate the ARB since, you know, we've been doing a

lot of work on the electricity and natural gas forecast to sync up with the PUC. And we certainly need this same sort of focus here.

Certainly, would echo Commissioner McAllister's comments about the importance of this area in a greenhouse gas context. You know, remind people that roughly 40 percent of our emissions are from transportation. Certainly, a substantial part of air pollutants, criteria pollutants come from transportation.

And so, the Governor's set very aggressive goals and we need to be tracking our progress on those and figuring out ways to do better as we go forward.

So, thanks.

MS. RAITT: Okay, our first speaker is Gene Strecker.

MS. STRECKER: Good morning Commissioners, stakeholders and staff. Thank you for taking the time out of your busy schedules to join us this morning.

I'm Gene Strecker, Supervisor of the Transportation Energy Forecasting Unit, or TEFU as you'll see in some of the slides later this morning.

Today we're going to be discussing our preliminary transportation energy demand forecast. And I'd like to stress the word "preliminary" in that.

And we'll also be talking about our plans for a revised forecast due to be out in the fall.

If you participated in our March 19th workshop, you heard about many of the inputs and assumptions that are important for transportation energy demand.

And if you participated in the February 26th workshop, you learned about inputs, assumptions and scenarios that are common to multiple Energy Commission forecasts, including transportation energy, electricity supply and demand, and natural gas.

And before we get started, I just have, hopefully, a simple request of you. Our second presenter today, Anna Wong, with ARB's ZEV program, has some constraints and needs to head out of here rather quickly this morning.

So, after I'm finished up, I would ask -- or I would appreciate it if you could hold your questions until after Anna has completed her presentation.

So, before we really touch on gasoline demand, I just wanted to throw a couple things out there because we've talked about some of these things back in our March 19th workshop.

Two of our very important inputs to our forecasts are fuel prices and vehicle attributes. EIA forecasts crude oil or prices for crude oil. And as you

know, there was a significant decline in crude oil prices last fall and EIA did not have their forecast for 2015 prices out in January, as they typically do. They didn't come out until mid-April. And so, updated crude oil prices, which are a primary building block for our forecasts, our fuel price forecasts, were not available when we did our preliminary demand forecasts.

So, you'll see Ysbrand van der Werf talk about our current fuel price forecasts and our revised fuel -- what we'll be using for our revised fuel price forecasts a little later this morning.

Similarly, we didn't have 2015 vehicle attributes available for our preliminary forecasts. So instead, what you'll see that we've used are the attributes that we presented in 2013 workshops.

And we do have new vehicle attributes that will be in the revised forecast later this year.

So now on to gasoline. You can see that in all three of our scenarios that gasoline demand is declining over the forecast. One of the reasons for that is because of the gains in alternative fuels. And another important factor is improved fuel efficiency in vehicles.

Gasoline demand is largely influenced by the demand for light duty vehicles. And Jesse Gage will

discuss this, along with other important factors that impact the decline in gasoline demand a little bit later.

Most diesel consumption is accounted for by medium and heavy duty vehicles. Essentially, this means freight trucks and transit buses.

As you will see a little bit later, an increase in natural gas vehicles essentially leads to an increase in natural gas decline, obviously, and this essentially results in a decline in diesel demand.

And I'll just move right on to natural gas because they're so connected. You'll see a substantial increase in natural gas demand through all of our cases.

And Bob McBride will talk about the factors that go into this natural gas demand when he talks about the medium and heavy duty vehicle forecasts this morning.

The main driver for transportation electricity demand is the forecast of PEVs. We're showing here three different scenarios of two different forecasts of transportation electricity demand.

In the three TEFU scenarios, represented by the dotted lines, it appears that there is no spread between the high reference and low demand scenarios.

Jesse Gage will explain this forecast in a little bit -- or explain the forecast of PEVs in a

little bit. And you will actually see, when we're on a different scale, that there is some variance between the three scenarios.

And other staff will explain the CED forecast, illustrated by the solid lines, at a workshop on July 7th.

So, hopefully, this is enough of a quick preview to keep you glued to your seats for the rest of the morning.

As I said, I'd like to turn it over to Anna Wong, before she has to run off to another commitment. And I'll be happy to take your questions after Anna Wong has completed her presentation. Thank you.

MS. WONG: Good morning. I'm Anna Wong. I'm a Staff Air Pollution Specialist for the California Air Resources Board. I've been the Lead Staff for the Zero Emission Vehicle regulation for about eight years. And currently, I'm undergoing a review of the regulation. But today, I'm going to focus on how the regulation works.

There was interest from the staff for me to present this. So, if you have any questions, just let me know. I didn't put everything in the regulation here, just the things that pertain to California.

The ZEV regulation is part of a broader Advanced

Clean Cars Program, which was adopted by our board in 2012, which later got rolled into the Federal Greenhouse Gas Fleet Average Standard Program.

And while the criteria and greenhouse gas programs are fleet average standards, the ZEV regulation is a technology-forcing regulation that requires vehicles to be produced every year, in increasing numbers through the 2025 model year.

Okay, so the most basic way to describe the ZEV regulation is that it's an annual requirement. And it's an annual credit percentage requirement.

And this percentage of credits that has to be produced from each manufacturer applies to each manufacturer's California vehicle population.

So, when you apply that credit percentage towards how many cars a manufacturer makes in California, you get their number of credits that they have to come up with.

And that number of credits is generated by producing zero emission vehicles, plugin hybrids, hybrids, and partial zero emission vehicles. Those hybrids and partial zero emission vehicles are very clean gasoline vehicles. They fall out of the program after 2017 model year.

So, 2018 and beyond, when we're talking about

much larger numbers, we're only focused on plugin hybrids and pure zero emission vehicles, which are battery electric vehicles and fuel cell vehicles.

Each of the vehicles earns a number of credits. Pure ZEVs tend to earn more than plugin hybrids. So, when you produce pure ZEVs, you don't have to produce as many if you choose to also produce plugin hybrids.

The largest manufacturers in California have to do this. Every manufacturer above, oh, about 3,500 sales, which is probably about 99 percent of the vehicle population, must comply with this regulation.

But the largest must actually produce pure ZEVs in compliance. But everything else is a flexibility. And that's why when we have our likely compliance scenarios and things, they are quite variable and up for -- we're not exactly sure how they're going to comply.

They also comply much earlier, which I'll show, than what is actually required in the year.

Okay, so I'm going to go through what vehicle technologies are actually included in the regulation. First, we have our full function battery electric vehicles. We call them BEVs or EVs. Mostly, we're seeing them through 75-mile range and 200-mile range, though we've seen more. And it seems like there's

trending to be higher range battery electric vehicles, which is really interesting. They're commonly on smaller platforms, with the exception of Tesla has, obviously, larger cars. So does the Rav4, which is a little bit bigger. They get between one and four credits.

And these are just some things that are on the road, available today, the Ford Focus, 70 miles real world range, the GM Spark, and then the Toyota/Tesla venture, the RAV4 BEV.

Then we have fuel cell vehicles. We call them FCVs or FCVEs, fuel cell electric vehicles, they're the same thing. We get really confused with these acronyms, so I want to clarify that. Mostly, these are in the much higher ranges so they earn more credit. They earn about four credits in our program. They run on compressed hydrogen and they're commonly on larger platforms. And we see them as a longer-term range solution.

You see below is the Hyundai Tucson fuel cell, which is currently available and will be available for next model year, as well. And the Toyota Mirai, which will come out later this year.

Okay, plugin hybrids are a little bit more -- they differ. there's not just one plugin hybrid. They

also vary highly in credit, so they earn about .3 credits to 1.1 credits each.

And blended plugin hybrids, which is like the Toyota plugin hybrid, the Toyota Prius plugin hybrid. They have a less powerful electric drive train and more engine operation is needed in order to power the vehicle, especially at highway speeds.

Non-blended plugin hybrids, like the Chevy Volt, which is pictured here, maximizes the electric range before the engine turns on. So, not until the battery is fully depleted does that engine kick on to then power the vehicle.

Why does it matter? Well, it seems to matter to the manufacturers. They've each kind of chosen a technology and seem to be really pushing the benefits of that technology.

Some would say that blended has a better overall efficiency and whereas non-blended really max's out the electric miles, or as some people might know it as EVMT, which is a common thing that's talked about now.

Okay, so those are the vehicles that are in the program going forward, after 2018 model year.

And who's required to comply? So over here, in the gray box, are the largest manufacturers in California. They make more than 20,000 vehicles

annually, in California, on average. You have the big three, Chrysler, Ford, GM, then the Japanese car makers, Honda, Nissan, Toyota. Then we have some Germans, BMW, Mercedes, and Volkswagen. And then Korea comes in with Hyundai and Kia.

Then we have the smaller manufacturers, the intermediate volume manufacturers, which this definition was recently changed. These manufacturers will be small through 2025, we predict. We don't think they're going to grow super -- as fast as what we were originally projecting. So, Jaguar, Land Rover, Mitsubishi, Volvo, Subaru and Mazda.

And the difference between these two is that the people in the gray box have to make pure zero emission vehicles. That's part of their requirement. And then they can backfill with plugin hybrids. But they have to make pure zero emission vehicles in compliance.

And then, the people in the green box, they can make ZEVs, but they do not have to. They don't have any limit on the number of plugin hybrids they can make in order to fulfill their requirement.

Okay. So, this is a common graph that you've probably seen if you've ever heard me talk about the ZEV requirements, or anybody else. This is a likely compliance scenario that we came up with in 2012, for

the 2012 amendments, where we get to about 15 percent of all new car sales in 2025 are a combination of ZEVs and plugin hybrids.

How I came up with this is that I assumed that all the manufacturers that could make the maximum amount of plugin hybrids did. And that everyone made the minimum amount of ZEVs that they would have to make.

Now, we're not seeing that. We're not seeing every company doing that. But this was just one way of looking at the possible compliance.

I ran a different scenario, assuming that all long range -- well, a mix of 100- and 200-mile range BEVs were made. We get a little bit higher because BEVs typically earn less credits that fuel cells. So, I'm still maxing out the number of plugin hybrids that are made in compliance. But I'm just saying, well, let's pretend that, you know, hydrogen infrastructure is still being developed and we can't rely as heavily on those as the original scenario allows for.

So, if all BEVs are made in their place, we get to about 17.5 percent of new car sales in California.

The way that I run this is that I'm always in compliance when I'm running my calculator. I'm just mixing the number of BEVs, or plugin hybrids, or fuel cells that are made in order to get into compliance.

But I'm always assuming that everybody is in compliance because we've always had every manufacturer be in compliance with the ZEV regulation.

So, how are we doing? I have data through August 2014. You can see, we're seeing a much bigger diversity of models. Each company has some skin in the game, which is really exciting news for us.

You can see the trend lines, that about half are pure ZEVs and half are plugin hybrids, which is really interesting to us. Most manufacturers would argue that plugin hybrids are more marketable. But what we're seeing is a large uptake, also, in pure ZEVs. Which is, I think, a really good sign.

And if I take this line and I put it onto our graph, you'll see that we are about -- we're trending about four years ahead of the requirement. And that's why it's really difficult to come up with a likely compliance scenario because I'm assuming that they're only making the compliant numbers.

But really what we're seeing is a banking of credits and then using those credits to sort of even out these big jumps that you see, like between '17 and '18. So, that's how we're sort of looking at it. As if you look always three years ahead, that's how you can kind of predict the number of vehicles that you might see on

the road.

And I think that that's it for my scenario.

MS. RAITT: Okay.

COMMISSIONER MC ALLISTER: Thanks very much for being here. Really appreciate your participation and the collaboration with ARB.

MS. RAITT: Next is Gordon Schremp.

CHAIR WEISENMILLER: Actually, I just wanted to ask her one question.

MS. RAITT: Oh, I'm sorry. Excuse me.

CHAIR WEISENMILLER: Sure. Do you -- along with electrification, the other thing the Air Board is really pushing is CAFE standards. And so, I'm trying to understand what we should be building into our forecast for CAFE standards, the existing ones, and what you would anticipate between now and 2025.

MS. WONG: So we are participating in a three-agency midterm review of the 2022 through 2025 greenhouse gas standards, with NHTSA and EPA. NHTSA obviously has to adopt new CAFE standards for 2022 through 2025 since they're statutorily not allowed to set standards out for five more years. So, we're working with them right now.

EPA and ARB have already adopted standards out through 2025. So, we're in a current review to see if

we got those right back in 2012.

A NAS report just was released last week that the agencies got it right. It might be, in their estimates, a little bit more expensive than what the original estimates were but other than that they're feasible, and doable, and that's really exciting news for us that that's coming out from a separate committee.

But that will all take place, the decisions on that will take place between 2016 and 2017, next year, and we'll know better where the 2022 through 2025 standards even out. But it's looking promising on that.

CHAIR WEISENMILLER: And my understanding is at this point there have been recent proposals for CAFE-like standards on heavy duty vehicles and perhaps aircraft, also.

MS. WONG: Yeah, I would not be the person to speak about that.

CHAIR WEISENMILLER: Okay.

MS. WONG: But I know that they're being considered.

CHAIR WEISENMILLER: Okay, so that's the other thing that we need to build in to what we're doing here. Thanks.

MS. RAITT: Okay, we'll move on to Gordon Schremp.

MR. SCHREMP: Thank you, Heather. Good morning Commissioners, Chairman, and attendees.

My name is Gordon Schremp. I'm the Senior Fuel Specialist in the Energy Assessments Division. I've been there, working with the Commission, going on a quarter of a century. So, that makes me sound old. I am older.

So, before I talk about what historical fuel demand has been for gasoline, diesel and renewable fuels, I'll give you a little context of how the system functions. And that has to do with sort of the structure of our refineries, locations, and how they're all interconnected.

I want to do a little compare and contrast with the fuel markets on a regional basis in the United States, there are some important distinctions between them, before I get to the final part of my presentation this morning on the actual numbers.

So, this whole system is basically all interconnected with pipelines, but the primary hubs are the refineries. They almost all have marine facilities associated or connected to them.

They do use rail for some aspects of their operations besides, more recently, crude by rail. And, of course, the distribution terminals that are the

location where the gasoline and diesel is loaded into tanker trucks before they go to the stations where everyone picks up their fuel.

So, there are some important distinctions. Crude oil and, say, fuel oil, residual fuel, or dark products as they're referred to, are a separate system of piping and storage tanks compared to cleaner products like gas, e-diesel, jet fuel, et cetera. And so, those are kept separate and you can't use those parts of the system.

And unlike electricity, of course, which is widely interconnected between Northern and Southern California, we don't have that connection via pipelines. And I'll talk a little bit about that.

So, the refineries are in Southern California, primarily the largest capacity, followed by the Northern California or Bay Area refineries. Some smaller facilities in Bakersfield and Santa Maria. Bakersfield does have some gas and e-diesel production, and the other, smaller ones are usually asphalt and unfinished oils.

So, it's a lot of capacity, about 1.6 million barrels per day. And the refineries essentially operate continuously unless, of course, there's some planned maintenance on some of the units or they've had a

significant unplanned outage, loss of electricity, they've had to go into emergency shutdown and that's when they'll go down.

So, the crude oil they receive is more recently primarily from foreign sources, as our California production has declined, along with a decline in Alaska as a source for California, which is now about 10 percent of our supply.

And we do see, we do continue to get a significant amount, about 30, 35 percent from in-state sources via pipeline. And a tiny bit by rail and a little bit of trucking, in some cases, to some of the refineries, but a very small amount.

So, marine terminals are very important to receiving crude oil. They're also important to receive gasoline blending components, diesel and gasoline when they need to import into California. As well as more recently in the United States, and in the West Coast, and in California experts of refined products. This is primarily diesel fuel. About 20 percent of all production of diesel fuel along the West Coast is actually exported to foreign countries.

So, that's more of a recent phenomenon with slightly lower crude oil prices, better refining economics have enabled U.S. refiners to be a greater

exporter to South America, Europe, and in some cases Southeast Asia.

So there's some -- all the refineries basically have their own facility, proprietary in most cases. But there are some important third-party providers. And some of these providers usually are for blending components, imports and exports of refined products, mainly.

So the rail logistics I mentioned are for things like butane, a seasonal blending component of gasoline exported during the summer, or sent to other locations on sitings because it can't be used in gasoline because of our summer recipe.

And more recently we've seen refiners and other third parties look to crude oil by rail as a potential import business.

So, pipelines are what allows everything to get to point A, B, C and D. They're a very important source of supply to the neighboring states of Nevada and Arizona, about 90 percent and 50 percent, respectively.

And the pipelines, like the refineries, pretty much operate all the time, 24/7. And you need to push or pump liquid into those pipelines to push the other liquid out to the distribution terminals. And those same pipelines are used to convey multiple types of

refined products in the same system, gasoline, diesel, jet fuel, and they repeat that cycle every seven, seven and a half or eight days.

This is just a diagram for Northern California, showing the system that goes all the way up into Nevada and as far north as Chico, and all the way down to Fresno from the greater San Francisco Bay Area. So, Concord pump station is a very critical component of this distribution system and that's where the pushing of all the in-line pumps start. And the refiners send to that location to go to these distribution terminals.

It's a very efficient means of getting the refined products spread further out to this very large geographic State, to where you deliver to distribution terminals, upwards of 60 of them. Almost all of them are connected to these pipelines. And really, very few of them have access to rail, so you're not going to be able to rail product to these locations.

But this is the point where the tanker trucks fill up their fuel. Ethanol is distributed to all of these distribution terminals via tanker truck and is stored separately before it is blended with gasoline, into the tanker truck before it goes to the service station.

So, there are an awful lot of tanker truck trips

each day because we consume an awful lot of gasoline and diesel fuel, upwards of 50 million gallons per day, based on the 2014 data.

So, these 10,000 locations, or thereabouts, this number does change. You see stations close, you see new ones open. But it's been the neighborhood of 9,600 to 10,000 for a number of years now. Fairly stable, even though the population has been going up, but gassing demand had not been going up very aggressively. And I'll talk about that in just a few minutes.

Average quantity of gasoline sold, about 120,000 barrels -- gallons, excuse me, I'm used to talk about barrels -- 120,000 gallons per month, per location.

And the table is intended to sort of break out the Bay Area stations, all of them in those counties listed. And an important takeaway is that there are significant variations in the average sales by location.

And we've all heard of hypermarts, Costco, Sam's Club, Safeway. Well, those are all in the very right column, 47 of them in this region. And that's about 1.6 million gallons per month. So, 12, 12 and a half times greater than the average for the entire San Francisco Bay Area.

We have a particular interest in these locations when it comes to contingency planning purposes, our fuel

set-aside program. We're interested in where these very large distribution locations are, in the greater Bay Area, that could be used as points of distribution in the advent of a catastrophic earthquake.

So, shift gears, talk about some regional fuel markets. This is an EIA graphic that divides the United States into these Petroleum Administrative Defense Districts. This sort of comes out of World War II.

And you see the large refined centers, the green dots, and clearly the Gulf Coast lion's share of refined capacity in the United States. A little bit up in the northeast, but California has the two locations I already talked about.

So, let's look at the West Coast. You've heard of California being isolated, isolated market. That's really it's grown up that way. We have a balanced system, essentially. We produce, pretty much, as much as we need locally, by the refineries. And that includes the regional, you know, Nevada, Arizona don't have any refining, Oregon has no refining, and Washington State.

So, this system is sort of self-contained and in balance. And so where we see issues is when a significant unplanned outage occurs you're losing eight to ten percent of your refining capacity in California.

And that's when you could have a significant price spike gas we've experienced this year, with the Exxon Mobile Torrance facility being down since mid-February, and they're about ten percent of the State's supply.

So, this geographic isolation doesn't mean you can't bring in components. It just means that you don't normally need to bring in. It's less than five percent of our supply for gassing our imports via marine vessel. And when we have an outage, it just takes time, many days, if not weeks, to start bringing in additional supplies.

So the compare and contrast is other parts of the United States. I'll talk about that Gulf Coast region. You see a lot of the arrows going away from the refineries. That's because they will produce between two and three times more products than are consumed locally.

Well, where are the others going? They're going to other parts of the United States, all the way up to the Eastern Seaboard, up to the upper Midwest and now, you know, foreign exports as well.

So when there's a major, you know, significant unplanned outage in that part of the country, the market response is very muted. Why? You haven't lost a large percentage of your local supply. It's very, very minor.

However, when all of the hurricanes go through and all of the refineries temporarily shut down as a precaution, you can have some downstream delay in receiving in those pipeline systems, and you can see shortages, temporarily, and price spikes further downstream.

Florida, you can see has no refining capacity, receives all of their imports along most of the Eastern Seaboard. And so, a refinery outage is very, almost insignificant in those regions.

Where they have a concern is a port closure. In the aftermath of Super Storm Sandy, difficulty getting imports into New York, Boston Harbor creates some tightness of supply and temporary shortage there.

So, imports matter, but a refinery outage really doesn't have much impact on the markets locally.

So, some of you remember the photograph on the lower right. There were attendants, and that's why they were called service stations. Now, they're called gas stations. So, they actually had people there and they would say could they wash your window, check your air, and your engine. No longer, really.

COMMISSIONER MC ALLISTER: Yeah, I'll just point out in New Jersey, where I recently was, that is still, I believe, the law actually. Although I'm not sure of

the level of service that you get, but somebody has to pump the gas for you.

MR. SCHREMP: And I believe that's also -- is that still the case in Oregon? It is still the case in Oregon. Yeah, so the two holdouts.

So, historical numbers, only back to post-World War II for gasoline. This is finished gasoline in California and this does contain ethanol. Really, since the early 1980s in very small quantities and then more recently, I'll show you in just a minute, in the near term what the volumes look like.

But we're looking at gassing demand that had been declining seven of the eight years. And this is, you know, in no small measure because of the mother of all recessions that hit us, and really took a lot of jobs off the market. And so, if you've lost your job, you're not commuting to work. And so vehicles miles traveled dropped, fuel consumption dropped.

And then we've seen more recently, with an improvement in the jobs market, our unemployment rate continues to drop, which is good news, and we're seeing a rebound in gassing demand.

On top of that, with a significant drop in prices that have occurred since last summer, crude oil prices have dropped about 50 percent globally, and

that's brought down fuel prices.

And what we're seeing in the first couple of months, in California gasoline consumption, compared to the first couple months of 2014, demand is up even greater than the 1.11 percent from 2014 to 2013. It's more than double that. So, there is a demand response, if you will, through improved employment and lower prices.

So, the near term basis, you see on the bottom, is the ethanol content, of which most recently it averaged a little bit over ten percent. And how are you able to do that when gasoline contains a maximum of ten percent by volume? And that's by selling E85. So, E85 is sold and some of that are stations that have got up and running from grants through this agency to help those companies purveying that fuel. And so, it's a little over 11 million gallons in 2014. And we expect that number to consider rising somewhat.

It's certainly an attractive fuel to help with compliance with the Renewable Fuel Standard, the Federal program, and it's an attractive fuel to help with compliance with the Low Carbon Fuel Standard. So, that's why we expect that to rise a little bit more in the coming years.

But the base gassing demand was down

significantly, over 12 percent, from 2003, the start point of this chart, to 2014, the most recent year of data. But it's come up a little bit, as I mentioned, and we expect gassing demand to continue to rise a little bit more as completely coming out of the recession.

And then, as Gene Strecker was talking about earlier, longer term in the forecast purposes, to decline for a number of reasons.

So we have been using our fuel more efficiently as time goes by. And this chart is broken down into two different comparatives. One is to say, all right, let's take all the gallons and divide them by the number of licensed drivers, and that shows a decline. About, you know, 27 percent between the peak in 1973, and 2013, the most recent data available for both sets.

And then starting from a slightly different point, 1978, a decline on a per capita basis. And, although we do recognize not every man, woman and child drives, nor should they be driving, especially the children.

So, it's improved efficiency over time. This is aided, clearly, by greater choice of more fuel-efficient vehicles. They're driven by, you know, and older CAFE program and more recently a newer one, and also consumer

preference when we had periods of very high sustained prices, when crude oil was over $110 a barrel. So, people were electing to select more fuel-efficient vehicles.

So over time that starts to have an impact on the overall fleet fuel economy and that continues to decline.

So, switching gears to diesel, my last couple of slides. I just want to point out there's some -- over this period of going back to 1976, sort of three tranches of increases. And it's changing each time.

So what you notice is it was almost, you know, a little over six and a half percent per year growth of diesel consumption. And go from 1993 to 2007, until we hit the big recession, almost four percent per year. Very strong growth.

And then after the recession, post-recession recovery, about two percent per year. And as Gene was pointing out in one of her first slides, we expect to see diesel demand to continue to grow, initially, over the near-term part of the forecast and then peak, and start to decline due to displacement with, say, natural gas for long haul.

And as the Chairman pointed out, more fuel-efficient regulations for heavy duty and medium.

So, I think, you know, something else in this data is -- I know people go look at the State Board of Equalization data and they won't find numbers like this. Well, why is that? Because we're interested in total consumption of the diesel fuel for all uses.

The Board of Equalization is interested in taxable events. What is taxable, what is a refund, what is nontaxable, what is exempt? Red dye diesel. So, red dye diesel figures, we obtain those from the Board of Equalization and we use them to examine all of their data to come up with what we believe is the total consumption of the diesel fuel.

And so those red dye diesel figures are not insignificant and they can vary from anywhere from 25 to 30 percent of total consumption each and every year. So, they are rather significant.

So, we think we have a pretty good picture on what total consumption is that will differ from somebody going online and looking at the BOE taxable diesel sales.

So like gasoline, diesel, but more recently, has been utilizing increasing quantities of biofuels. And this is driven for biodiesel by the Renewable Fuel Standard, which has a biodiesel component, and by the Low Carbon Fuel Standard, where one would be compelled

to use lower carbon, renewable diesel, say from Neste facility in Singapore, and displace carb diesel. So, that's a good fuel under the Low Carbon Fuel Standard. So, we expect to see more of that as time goes by. But there are some volume -- you know, feedstock limitations to producing that fuel, that everyone's really aware of.

But we do track that and, but we do think it's going to be an important component moving forward over the near term.

So, be happy to answer any questions you have at this time. Okay, thank you.

COMMISSIONER MC ALLISTER: Thanks, Gordon.

CHAIR WEISENMILLER: Oh, I actually have one question for you. When we do the demand forecast, how do we handle some of the exports from our refineries to other states? I mean what percentage is that and how is it factored into our forecast?

MR. SCHREMP: What we have done in the past is we look at -- we have a local demand forecast. We look at the neighboring states of Nevada and Arizona and have some projections based on regional EAI projections.

And the reason we're looking at that is we want to see what kind of change in demand on the pipelines leaving -- going to California. And back in the late 1990s and early 2000s, this was becoming an increasing

concern of running out of capacity to exports on those pipelines because the demand growth was so strong, say, in Nevada and Arizona. And, really, no pipelines coming, not a lot of capacity from the east.

So what's changed since then is demand for fuel regionally has gone down. This is recession-based. But there's been some new pipeline capacity from, and capability from the east, going into Arizona, and from Salt Lake City refineries going into North Las Vegas.

So, that sort of changed the dynamics. Kinder Morgan used to be concerned about running out of capacity and was looking at expanding. So, we look at that to see what kind of potential change in exports via pipeline.

Now, the other part of exports from California, or what's been going on in the United States, and those are exports of opportunity because the economics are good to expert to, say, South America, Western Canada from California.

So, as long as the relative economics are favorable, high refining margins, discounted crude oil price access, we expect to see those exports to continue.

And even against the backdrop of expansion of refining capacity in the Middle East, and in Brazil, and

in South America, projections I've looked at for refining capacity additions in those countries, related to their demand growth are falling short.

So, it's not like this new refining capacity is going to displace exports coming out of the United States over the near term, but that may change, you know, going forward midterm. And it may change especially if, say, crude export restrictions are altered to allow crude oil exports from the United States, which could change the crude oil base prices and affect refining economics.

MS. RAITT: Great. Our next speaker is Ysbrand van der Werf.

MR. VAN DER WERF: Okay, thank you, Heather. And I am talking today on -- well, I'll be reviewing the fuel price cases from our preliminary transportation forecast. And I'll be updating two of those preliminary forecasts, namely petroleum and hydrogen.

So, first I will simply recap what was presented at our April workshop. And beginning with the cost of petroleum.

Now, when this was -- these three scenarios here were originally presented back in April, that was before EIA had released their 2015 forecast. So, I just sort of cobbled together these three different price cases.

And there's not a whole lot of variation in them.

And since that workshop, EIA has released their 2015 forecast, so I have prepared new cost cases for petroleum, which we will see shortly.

And similarly, that also affects -- well, we have here the price of gas, gasoline and E85, from the April workshop. Now, the price of E85 is just a proportion of the price of gasoline, roughly 84 percent as I recall. And these also change with adoption of the new -- well, incorporation of the new petroleum price forecasts from EIA.

And the same can be said for diesel and jet fuel. Diesel is the solid line, jet fuel is the dashed line. We will see three new scenarios for those fuels.

And here we have natural gas and electricity. And those do not change with the change in the petroleum forecast. So, these numbers stay the same and they are not revised at all. These numbers are what is what we are currently using at the Energy Commission in our forecasts.

And lastly, here, we have hydrogen prices. And these are -- what we have here are very low prices, very flat. They don't change much over this 11-year period. And those have been revised a great deal. We've gotten a lot of information, we've engaged in a lot of

discussion amongst the experts here at the Energy Commission, and we have some very different hydrogen numbers. So that is the recap of our preliminary prices.

And now, moving on to the proposed changes to the fuel price cases for our revised forecast. First, as I mentioned, updated petroleum price forecasts based on new forecasts from EIA.

And second, revised hydrogen price forecasts that are based on newly available data and a new analytical tool which was used to prepare the scenarios.

And doing the petroleum, first. The preliminary prices that you saw earlier, those -- as I said, those were just adapted from last year's EIA price cases. And as soon as the EIA released their 2014 annual energy outlook I prepared new price cases based on the new EIA forecast. And this has the desirable effect of producing a lot more variation between the cases.

And here, here we see the new cases and the old cases. So, the previous cases are the dashed lines. They're all very close together. They do not -- what, they stay between about $70 and what is that, $90, with the exception of this year, of 2015.

And there's a great deal more variation with the new price cases. In 2026, they range from $60 up to $160. Now, one reason we get so much variation is if

you look at 2015, you'll note there are three different prices in the new -- for the new cases. And as the year goes on, the 2015 data will be updated for our revised forecast. Because this year the oil, petroleum prices have been so volatile and unpredictable that, you know, we're just going to -- as more data becomes available, as the year goes on, we will hopefully get -- we will get this prices to converge to some single point.

And the 2016, 2017, those years may be adjusted to fit the 2015 datum.

And that's basically it for petroleum, it's just we've got some better material to work with. We've got a good range in prices.

COMMISSIONER SCOTT: Ysbrand, could you tell us a little bit more about -- so, it's just the volatility of prices that's causing this much greater variation in what we anticipate the dollars to be? Or what is it about 2015 numbers that we have so far that's causing such a big variation compared to what we had with the 2014 numbers?

MR. VAN DER WERF: Well, in 2014, the prices were, what, $100, $110 per barrel, more or less, and began to decline late in the summer and really plummeted beginning the Monday after Thanksgiving, when OPEC held their meeting. And they got down to, as I recall, down

below $60. And so, you can see that in the low price cases that the 2015 number is roughly $50 for both of those.

And since then, I mean, there's been a lot of speculation about what's going to happen with production in North America. Will American producers have to cut back because they are high cost producers? And if they do so, if they do cut back production, would that in turn drive the price of petroleum back up?

Then there's a lot of evidence, people say, well, no, a lot of the oil companies, the producers are cutting back the number of wells they drill, but at the same time are managing to increase production through better production techniques and focusing on sort of the sweet spots of the areas where they're doing the drilling.

So, and this is a situation that has never -- it's a new situation that hasn't been seen at all in the petroleum industry. Because the shale wells, they can be drilled so quickly and they produce at a very high rate, they give a very high rate of return for about two or three years, and then the production drops off.

So, nobody really knows how that's going to play out compared to a more traditional oil well where the decline rate of production is very gradual, over 20

years or so.

Now, that said, very little shale oil actually makes it to California, but it still affects the price that we pay in California. So, one reason for this huge range, what we've got about $50 going up to close to $90, it's -- nobody really knows.

But as the year goes on, well, we'll know what happened in August by September. So, these numbers will converge and we'll just have a better idea of how this new dynamic works with the shale oil production.

COMMISSIONER SCOTT: Thanks.

COMMISSIONER MC ALLISTER: Ysbrand, could you -- I mean, I sympathize with the relative futility of trying to predict the future with oil prices because, you know, you sort of -- you know, it's a straight line because how are you going to do anything else? But it's never, in retrospect, anywhere near a straight line.

So, I guess, could you maybe describe some of the techniques that you use to -- I mean, I kind of understand intuitively why that range is so big because the scenarios are all over the map, literally.

But I guess, could you talk about some of the analytical techniques you use to capture past experience and reflect that in the forecast going forward, in terms of the variability that we might see going forward?

MR. VAN DER WERF: Well, let's see, for the -- the high scenario, the high price scenario, that assumes that production really gets cut back substantially in North America. That the shale oil, I mean, really is high cost and cannot continue to compete. You know, they can drill their sweet spots for maybe two or three years or so, but then they move on to more areas that are more expensive for them to drill. They don't develop new -- currently, there's a lot of technological innovation in shale well drilling. Well, maybe that becomes too expensive or it just doesn't continue to improve, you know, five or ten years in the future, and that keeps production low within the United States, and you end up with a higher price of petroleum.

So, does that give you an idea or --

COMMISSIONER MC ALLISTER: Yeah, I guess -- yeah, more or less. I was wondering if you used some analytical techniques to sort of calibrate from past experience --

MR. VAN DER WERF: No.

COMMISSIONER MC ALLISTER: -- and then kind of adopt some ranges kind of based on that variability? Different technique than what you just described?

MR. VAN DER WERF: Well, I wouldn't go so far as to call them analytical techniques. Just examining

different combinations of different outcomes. And again, I based these on the EIA forecasts.

So for the low demand -- well, the low price case here, the bottom line, that would be a situation where the -- you know, the shale oil drillers are -- pardon me, shale oil producers are able to continue driving the costs of production down, they decrease the amount of space between the wells, they keep production very high and that keeps the cost low. And, you know, the most profitable, most productive oil fields are able to continue producing at very high rates, and that keeps the price low, in the low price scenario.

And this is what's going to -- what's going to happen? Well, nobody really knows because this is a new situation. I mean, the shale oil drills -- pardon me, shale oil wells were drilled when the price of oil was very high. Well, now, suddenly, the price has come down a lot. Exactly what's going to happen? Nobody's really sure. There are a variety of opinions.

COMMISSIONER MC ALLISTER: Well, I guess that was kind of the origin of my question, right, is that we -- exogenous factors have driven that reduction in price. Really not -- you know, partly it's been what Gordon talked about, you know, our lower demand in this country and everything.

But the international price has been driven by lots of different things. And I guess I'm trying to figure out how we capture those uncertainties about similar dynamics in the future and incorporate those kind of in our scenarios?

MR. VAN DER WERF: Those are very unpredictable.

COMMISSIONER MC ALLISTER: Well, that's kind of my point is that we need to capture that somehow.

MR. VAN DER WERF: Yeah. I mean, part of it assumes that OPEC, Saudi Arabia, in particular, wants to keep on producing at a high rate of production.

COMMISSIONER MC ALLISTER: Yeah, exactly. So, is there a scenario where we -- you know, Saudi Arabia sort of does a U-turn and drives prices back up, and where would that kind of -- I mean, obviously, that would be towards the high demand case.

MR. VAN DER WERF: Yeah.

COMMISSIONER MC ALLISTER: But, you know, is that sort of variability explicitly captured in the way you approach this kind of thing?

I guess, and it looks like Aniss has a response.

MS. BAHREINIAN: This Aniss Bahreinian, you know, for the reporter.

As Ysbrand mentioned, these are based on EIA's price forecasts. Crude oil prices are raised on the

EIA's price forecast.

And about a couple months ago, we had Dr. Daniel, from EIA, who was making presentations to us about these prices. And one of the factors that he explained, you are specifically asking if we are using any analytical model. So, I'm going to refer to what EIA is using, rather than us.

And one of the explanations that he offered was that when it comes to crude oil prices, they basically use a panel of experts. So, if you're looking for an analytical model, it's not there because of the complexities and uncertainties.

And he also explained that for the first time this year, I think, they are using what is called a "toy" model. So, it's not a model per se, it's a toy model where they're exploring all the different uncertainties according to their panel of experts. And they try to go about it in a more systematic way.

So the short answer is that mostly it's this panel of experts that are generating these forecasts.

COMMISSIONER MC ALLISTER: Okay, well, thanks. I mean, keying off of the EIA, I mean it is obviously a reliable strategy for us in terms of having something to base it on.

But, you know, I guess the fact that they're

just now getting to figuring out if there's a structural way to approach this model, sort of is a reflection of the complexity. But, hopefully, they'll be successful and we can build on that. Thanks.

Thanks, Ysbrand.

MR. VAN DER WERF: And that concludes what I have to say about petroleum revisions here and we'll move on to proposed new hydrogen price cases.

So, there are two basic facts here. One we have actual -- I mean, a great deal of data. And two, an analytical tool to develop these scenarios.

So first, the data. I base things on a $15-per-kilogram of hydrogen price. This is from data from within the Energy Commission, within the Emerging Fuels and Technologies Office, data that is reported to them by stations that they fund.

And the EFTO, Emerging Fuels and Technologies Office, has a variety of other data, station costs, and so forth, that is also very helpful here.

And the analytical tool that was used to develop the scenarios is the Hydrogen Financial Analysis Scenario Tool, H2FAST, which is available from the National Renewable Energy Laboratory, or NREL.

And there's the website. Anybody can go and download it for free. It's not that difficult to learn

to use in some fashion.

And at the end of my presentation I actually have a list of the various inputs that I used to come up with my scenarios.

And so, this is an analysis scenario tool. So, it does not produce forecasts. But I used it to test the validity of my forecasts. You know, the station wants to charge $5-per-kilogram. Well, the H2FAST tells me that station is going to just lose a lot of money and that's not a realistic scenario. So, that's how I used this tool, just as a reality check.

So, the noteworthy changes in hydrogen prices. First, these scenarios or cases, they now include all components of producing and retailing hydrogen. And one interesting finding is that the cost of methane is quite minor, almost negligible, it's less than five percent of the total cost of the retail hydrogen.

And there are -- while the technology of producing and compressing hydrogen, those -- well, producing hydrogen and compressing gases, those are both well-established technologies. It's been around for decades. Those are unlikely to change. We're probably not going to get many cost reductions from those portions of the process.

On the other hand, the technology of hydrogen

retail stations, that is new and we could see good reductions in cost there. And a key factor there is the utilization rate of the station.

So, if you have a station, you know, that's a fixed cost. You've got to sell fuel to recover the cost of the investment in the station. And so, you need to sell fuel. The higher the throughput, the more fuel you sell, the lower the cost of retailing the fuel. And that accounts for a large -- well, we'll see that's a very important factor.

And lastly is that more data will be available for the final forecast. EFTO will be receiving data from an increasing number of stations, you know, pretty much every month from now until I don't know when.

So, for the final forecast, there should be even better data available, especially on the purchase price of hydrogen.

So, this is a hydrogen station cost breakdown. It says it's a representative station for 2014, using offsite SMR, offsite steam methane reformation.

I would emphasize that this is not only a representative station but it's really, it's a hypothetical example. Okay, so the numbers there, they're all nice and round numbers. So, this is just to illustrate where -- why is it $15 per kilogram.

And the first row, the cost of natural gas is 60 cents of the $15. That's less than five percent of the total. And that includes an allowance for renewable -- well, pardon me, for using biomethane to produce renewable hydrogen.

And the cost of the hydrogen production is also not that high, that's less than ten percent of the total retail price.

Now, what was a surprise to me is the cost of compressing the hydrogen is so high, that's over a quarter of the total cost. And then the transport cost, that of course will vary somewhat, you know, depending with distance. Here, I used $2.

But we've got, those four items account for $7.80 of the $15 retail price in this example. That's over half the cost. So, and we're not going to get much cost reduction in those areas. I mean, the cost of transport will vary somewhat, but those look like they're pretty solid costs that aren't going to go away.

Now, the next item, we move from production and transport to retailing. And this example has a station using just 50 percent capacity, which seems to be reasonable for 2015, and that accounts for $6, 40 percent of the total cost of the retail price of hydrogen.

Now, and that's something that could come down. First, if the station gets used at higher capacity, well, that will lower the cost of retailing the hydrogen. And there's also room for -- it's a new technology, perhaps there will be better ways of producing hydrogen stations that will lower the cost from $6. And so that's where, if you want to reduce the cost of hydrogen, that's where a lot of effort could be focused.

And then, lastly, sales tax of 8 percent.

COMMISSIONER SCOTT: I have a couple questions for you there. Just to make sure I understand the retail at 50 percent station capacity. So, what we're thinking here is if a station could do -- has a capacity of 180 kilograms a day, they're actually only selling 90 kilograms a day.

MR. VAN DER WERF: Uh-hum.

COMMISSIONER SCOTT: Okay, and so if they were selling more, then that price could potentially come down a little bit, that's the $6.

Okay, and then on the compression piece, is it the electricity that you need to run the compression technology or what is it that makes that component so high?

And then you mentioned that it probably wouldn't

have much wiggle room in terms of coming down.

MR. VAN DER WERF: Well, I'm not -- I really don't know much about the technology of gas compression. But it's been around for, you know, decades.

COMMISSIONER SCOTT: Yeah.

MR. VAN DER WERF: If there were a cheaper way of doing it, somebody would have found it. So, let me address the -- you mentioned the cost of electricity in compression. Well, in the H2FAST tool, that incorporates, you are able to adjust the cost of electricity at various points throughout the process. And so far, I haven't done much with that area -- in that area.

So, you're talking about possibly some sort of renewable electricity that --

COMMISSIONER SCOTT: Well, no, I was just wondering what the cost of compression is based on. Does that makes sense? Does it cost $4 to do the compression because you're paying for the electricity that runs the compressor or what?

MR. VAN DER WERF: Well, it takes a lot of energy. I mean, if you compress a gas, that raises the temperature and it takes energy to raise the temperature of anything. I mean, I'm not an engineer.

COMMISSIONER SCOTT: No worries.

MR. VAN DER WERF: I'm afraid I can't really say much more than that.

COMMISSIONER SCOTT: That's okay. That's okay.

COMMISSIONER MC ALLISTER: How much of this -- I guess, just building on that. I mean if there are -- I'm not sure if we have a technical person on this, but hydrogen is quite difficult to handle, right? I mean, that's why it's, you know, hard to do Sterling engines and all that kind of stuff, and molecules escape from kind of wherever they are and that's difficult for infrastructure. I guess, I'm wondering if the compression is part of that problem or if it's something different? Anybody?

Okay. Oh, well, I think we're at the limit of our in-room knowledge here, but that's okay.

MR. VAN DER WERF: Okay. Oh, so now let's just -- I'll discuss some of the assumptions I made in my scenarios.

Just to keep things simple, I assumed that the cost of building a retail station is uniform and uses the lowest -- it's the lowest cost available of current technologies. And that's information that I obtained from EFTO.

And I also assumed that all stations use offsite steam methane reformation and transport hydrogen to the

retail station, just as in my previous example.

And I also assume all stations use biomethane as a feedstock to produce renewable hydrogen, and this is implicitly incorporated in the scenarios. And the cost of the methane is really quite minor in the overall cost structure of hydrogen.

And I also assume a station lifetime of ten years, partly because that's just nice and convenient. I'm looking at a ten-year period. I don't have to produce any replacement costs of any kind.

But I'm also aware that this may be very over-optimistic. I recall seeing somewhere that these stations might only have a life of four years and that would complicate any sort of forecasts.

So these, here we see the dashed lines at the bottom are the previous forecast and the solid lines, up at the time, are the three scenarios I produced using the starting price, the 2015 price of $15 per kilo. And then the three scenarios I developed using the H2FAST tool from NREL.

And so, these are real prices and I just produced one for the cost stays -- the price stays at $15. Another where it goes up to $20 by 2026. And one where it does come down to about $11 by 2026. So, there's -- that's a pretty good range starting from a

$15 base.

And the assumptions, the different assumptions I made for each case, the low price case, a lot of the assumptions I make have to do with how the stations are funded. And I assume the cost of building the retail stations is constant and funded with grants for two-thirds of the construction costs.

And then, retail stations receive operation and maintenance grants, O&M grants for two years, because that is -- they are not selling enough hydrogen immediately, in the near term, to meet their costs. So, I assume they receive two years' of O&M grants.

And third, in the low price case I assume that the capacity usage increases up to 80 percent over five years, so that's the fastest rate of increase of the three cases.

And it may well be possible to improve on this scenario. Somebody else could develop their own scenarios using NREL's H2FAST. I mean, that's an excellent tool. And if somebody can produce a scenario that does better than this, with good data, that would be great to see.

Now, the mid-price case is, again, the cost of rebuilding the retail stations remains the same and the construction costs continue to be funded with grants.

We continue to see O&M grants for two years. And retail station usage only increases to 70 percent of capacity and it does so over eight years. So, that's not quite as favorable for the price of hydrogen.

And then the high price case, which is really the interesting one -- well, let me point out this mid-price case, it's not just a static case. The number of vehicles and the number of stations are growing over the years, but it's fairly balanced so that the price stays at about the current level.

Now, the high price case, what's going on there is high station costs drive high retail hydrogen prices. So, for a given number of vehicles, so this is a supply forecast, so I hold demand constant, stations are used at a -- well, stations that are used at a low percentage capacity, well, then sales per station will be low. And if -- so that will -- if sales per station are low, meaning the quantity of hydrogen that's sold is low, well, there's very little -- there's not much -- you've got to have volume to produce the revenue. And if they're not selling much hydrogen, that's a problem.

And second, even if the number of stations grows, we can still have this situation developing if it grows faster than the number of vehicles. So, the number of vehicles can grow, but if the number of

stations grows at a faster percentage rate, the cost of retail hydrogen can continue to increase.

And the higher the number of stations, the fewer of those stations will sell enough fuel to pay their own costs. And the fewer number of stations that can pay their own costs, the greater the need for O&M grants.

So, it's possible to imagine a situation in which every hydrogen station receives O&M grants, and that could consume, you know, a sizeable proportion of money that is currently used to fund the construction of new stations.

So, that's how the high price scenario happens. You just build out a lot of stations quickly and spend a lot of money on O&M grants.

So, let's look at --

COMMISSIONER MC ALLISTER: Let me actually -- I want to just jump in here. I guess we do have Gary in the room, now, for the technical stuff. I just wanted to make sure we got a response to some of the challenges and maybe get a sense for how those prices might come down over time in terms of the supply, and the compression, and et cetera. Thanks, Gary.

MR. YOWELL: Good morning, this is Gary Yowell. I am the mechanical engineer and so I did look at these numbers.

So, I think the question was specifically about the compression cost, correct?

COMMISSIONER MC ALLISTER: Yeah, and if you know of any other sort of supply challenges in terms of the technical side of how to get the hydrogen in the right form in the station, and where maybe cost improvements might come from?

MR. YOWELL: I don't know where any cost improvements are going to come on this. We have 20 years' experience selling natural gas the utilities, for compressed natural gas vehicles.

Today it costs about $1.50 to compress a hundred standard cubic feet of natural gas. A kilogram is about 3.8 times that much. So, you know, four times the volume you have to compress.

Today's compression costs a third for the station, a third for maintenance and a third for electricity, fundamentally. And so, those costs just roll right into the hydrogen.

COMMISSIONER MC ALLISTER: So on that you layer on the stripping the hydrogen out and then essentially a similar process or a more difficult process for the compression?

MR. YOWELL: It's more difficult because it's higher pressure than what we sell for methane today, but

it's similar in the energy costs.

COMMISSIONER MC ALLISTER: So the fact that the methane molecules are kind of bigger and easier to manipulate than hydrogen --

MR. YOWELL: They're smaller. They're the smallest molecule that --

COMMISSIONER MC ALLISTER: Hydrogen, right?

MR. YOWELL: Hydrogen, I'm sorry.

COMMISSIONER MC ALLISTER: Yeah, so methane molecules are bigger and a little bit easier to handle.

MR. YOWELL: Right.

COMMISSIONER MC ALLISTER: So I guess I'm just wondering if there are any additional complications because of hydrogen, itself, or if it's basically the same problem.

MR. YOWELL: Similar problems. Metallurgical differences to deal with on the compression side.

COMMISSIONER MC ALLISTER: Yeah.

MR. YOWELL: And a smaller gas is very difficult to contain. Hydrogen's the most hard, it's the smallest molecule. It leaks everywhere, so you have to be very careful about that.

COMMISSIONER MC ALLISTER: Yeah.

MR. YOWELL: But lowering the cost, I don't see a significant opportunity on the compression equipment,

alone.

COMMISSIONER MC ALLISTER: Oh, okay. Okay, thanks.

MR. YOWELL: Retail side, maybe.

COMMISSIONER MC ALLISTER: Okay, great, thanks very much.

COMMISSIONER SCOTT: Could you just, one more time it was the three things, it was a third for the station, a third for the electricity and a third for? I missed the last one.

MR. YOWELL: Maintenance, electricity and a capital recovery for the compressor.

COMMISSIONER SCOTT: Got it, okay.

COMMISSIONER MC ALLISTER: So, is there any -- let's see, so you're -- this scenario, you're reforming natural gas, right, to get the hydrogen like on site. So, you're getting it to the site, you're reforming it and then you're compressing it.

MR. YOWELL: Right.

COMMISSIONER MC ALLISTER: Oh, okay, but you are at some level -- some place in the supply change, relatively distributed you're reforming, right, or --

MR. YOWELL: At the production site, correct.

COMMISSIONER MC ALLISTER: At the production site, right. So, how would this look different if it

were renewable biogas?

MR. YOWELL: The cost would be contained in the production site of the biogas, it would just be a little bit higher, the production site.

COMMISSIONER MC ALLISTER: The natural gas line would just be, you know, biogas and be more expensive, probably.

MR. YOWELL: Correct.

COMMISSIONER MC ALLISTER: Okay.

MR. YOWELL: Or less, depending on the LCFS program.

COMMISSIONER MC ALLISTER: Yeah, exactly. Okay, great.

COMMISSIONER SCOTT: But I think as Ysbrand was talking, you said that the 60 cents includes the biomethane component, right, renewable natural gas component?

MR. YOWELL: Yeah.

COMMISSIONER MC ALLISTER: Oh, I missed it. Okay, great.

MR. VAN DER WERF: Yeah, so I assume that all the renewable hydrogen is from biomethane.

COMMISSIONER MC ALLISTER: Oh, so this natural gas line is a biomethane line or --

MR. YOWELL: It could be viewed that way.

COMMISSIONER MC ALLISTER: Okay.

MR. YOWELL: Yeah, as being one-third biomethane and two-thirds natural gas.

COMMISSIONER MC ALLISTER: Okay, okay, I missed it. Okay, thanks very much. Great.

MR. VAN DER WERF: Let's see, well, let me -- here, this is the table that includes the inputs I used for H2FAST. These are common to all the scenarios I had. And here, how the scenarios differed by the inputs.

So, for the high price, demand ramps up slowly, the low price demand ramps up quickly and has higher utilization rates of capacity.

And I also assumed that the low price has a higher capacity station that is also at a higher cost.

And then, price escalation rate, 1.9 percent is the default inflation rate for H2FAST. So that's how I get the mid-price real price to stay flat is by using increasing at 1.9 percent every year.

And these numbers, the price escalation rate, 4.75 percent, it goes up 4.75 percent a year for the high price scenario. Because if I try putting the escalation rate lower, the stations were losing money there. They had negative cash flow for a number of consecutive years. And that was just one of the tests.

It said it wasn't realistic to have something lower than 4.75 percent.

And I tried, similarly, for the low price scenario, the price escalation rate is minus one percent, so the price goes down one percent a year.

And I tried it with if it goes down like, say, two percent a year, you know, to get the price down further. But with these other inputs that just -- again, that resulted in negative cash flow for a number of consecutive years. The stations wouldn't be able to operate under those circumstances.

These are, the high price and the low price are situations where the stations are just making money. So, I mean, there's room for -- especially at the low price, if somebody can come in with, you know, some different, better capital costs, or better capital costs per unit capacity, I mean that would be great information to have.

And if, you know, these inputs that I've put in, if any -- if we can have actual, you know, data that points out there might be better ways of doing this, less expensive, I mean that would be something I would be very happy to see.

But now, let me just wrap up here. So, just comparing the preliminary retail price that was

presented at our April workshop with the proposed revised price, the graph on the left is the preliminary. The graph on the right is the proposed revision.

And for jet fuel, diesel and gasoline, those are the blue, orange or gold, and the green lines. Those have changed a little bit from in the revisions but I mean, obviously, the biggest revision is in the price of hydrogen. That's gone from, you know, about $5 up to $15. That's about tripled.

And the high energy case we see, you know, something similar again for the gasoline, diesel and jet. But the price of hydrogen has jumped dramatically, almost tripled in 2015, and it continues, it increases at a pretty good rate over the next ten years.

And then the low case, while we see pretty much the same pattern with gasoline, diesel and jet fuel, they're a little bit different. And the 2015 value for the hydrogen has, again, more than tripled. But this time it comes down. It comes down to $11 in real terms by 2026. And that's about as far as I could figure out a way to get the price down.

And, you know, there might be ways for somebody else to come up with a different type of station, a lower cost station, or so forth, that would be great to learn about. And I'll be in communication with the

Emerging Fuels and Technologies Office. They've been a great resource for me to develop these scenarios. And so, we may have new information from within the Energy Commission that would change some of these, the hydrogen forecasts. And we will definitely, we will have more data by the final forecast.

So that -- oh, and let me point out that this phone number here is incorrect. And this was also the phone number presented at the April workshop. So, we finally figured it out. The correct number is 654-4531.

COMMISSIONER SCOTT: No, I was just going to say that I appreciate you also staying in touch with the Emerging Fuels Office because --

MR. VAN DER WERF: I couldn't have done it without their assistance.

COMMISSIONER SCOTT: Yeah, absolutely. And this is a potentially tough space for scenarios because we've got, you know, ten stations or so operational right now, and we're really just kind of getting the data in as additional stations become operational. So, I appreciate the work that you've done to put this together.

MR. VAN DER WERF: Well, thank you.

COMMISSIONER MC ALLISTER: Thanks a lot for the presentation. I totally second that. And, you know, a

lot of this is what we really need to move forward in a way that's responsible from the policy perspective, but just also keeping it real is learning from the experience that we have as we get more stations, and there are actual customers, and actual owners of those stations, and actually use of those vehicles that we really try to characterize that. Even though they're small, that's the only sample we've got, right.

So, we need to just start where we are and make sure that we're learning as much as we can as we go forward. Really, that ground-truthing, I think is really key for helping the Commission and the ARB make good policy around this. So, thanks.

MS. RAITT: Thanks, Ysbrand.

Next is Jesse Gage.

MR. GAGE: Thank you. I'd like to start by stepping away from the models, themselves, for a bit, and give some discussion of the thought processes when it comes to purchasing a vehicle.

When somebody wakes up in the morning and thinks about what should be in his or her driveway, a number of questions come up. And for purposes of this discussion, there are three in particular I'd like to focus on.

First, do I, my family, or my business even need a car in the first place? If so, how many?

Focusing on the personal sector, that depends largely on the household's background. A single person, making 30K a year, will reach a different conclusion than a family of five, where both parents work and pull in six figures.

Second, what kind of vehicles should they be? Do I need a truck, an SUV? Does that empty space in my garage kind of look like a Maserati?

Demographics clearly play a role here, too. But you also need to consider the characteristics of the vehicles, themselves. Price, speed, mileage, how many kids and groceries will fit, that sort of thing.

Finally, we can think about what fuel that vehicle should use. And by fuel, we also consider technologies, such as hybrids, PHEVs, FFEs, and the like.

At this point, demographics start to take a back seat. But attributes are still pretty important here, mileage and price, in particular. So, too, are contemporary fuel prices. When gas is cheap, there's less incentive to move on to something else. Which, as you know, is a lesson we're learning this year, at least on the national scale.

Now, there's three points I'd like to stress about this list. First, it is certainly not an all-

encompassing decision tree. I mean, if this were Family Feud, I'm sure new or used would be on the board. Vehicle incentives can also sweeten the pot, when you really start to do the research.

But this will give us plenty of context for today and perhaps, in September, there can be a look at some of the other factors.

Second, when folks ask themselves these questions, they generally ask them in this order. You're not going to wonder what kind of car you need, if you don't need one.

And in 2015's market, the question of fuel type is constrained by the kind of vehicle you need. If you want to go full-on battery, for example, but you absolutely need a minivan, then at least for now you're kind of out of luck.

Finally, I also need to point out that this is not, not a diagram of the vehicle choice models or the California Vehicle Survey. The models ask these sort of questions, but in a more abstract sense, and include other data, exogenous forecasts, parameters derived from the Vehicle Survey, and they all go in to the wood chipper that is any econometric model.

Furthermore, the personal commercial vehicle choice models consider these factors differently.

That's why there are two models.

Ms. Bahreinian has gone over the various models several times in the past, so I won't belabor the point, except to mention that these factors do, of course, have significant impacts on the models. And we'll look at those factors and their consequences today.

Let's start at the top. When every household and business in the State make their own individual decisions regarding vehicles, the resulting aggregate becomes the total vehicle stock for California. This is driven by economic, and demographic factors, and trends.

As you've heard, there are three common scenarios, each with its each econ/demo forecast from separate sources.

Let's look at population, first. The Demand Analysis Office is using updated projections from the same sources as in 2013, IHS Global Insight, Moody's, and the Department of Finance, in descending order.

These cases are presented here. And you can see by the chart that there's really more consensus than the contention. There's never more than a two percent different between the lot of them, and the high and reference cases are nearly identical.

What's more, the lines are parallel. That is the rate of change per year is effectively equal in all

three scenarios. In fact, they're so similar that if you look at the Y axis, you'll see it has to start at 30 million vehicles to accentuate what difference there is.

From a forecast perspective, this means the three population projections are not going to contribute much when it comes to differentiating the total stock forecasts.

So, all right, let's take a look at the economic scenarios, maybe they'll make a greater impact.

The three gross State product forecasts come from Moody's and IHS Global Insight. Here, the high case diverges a bit more, trending upwards at about five percent per year. But the low and reference trajectories stick together and have a more modest four percent annual increase.

All in all, though, it's kind of the same story as population, just with the reference case tracking the low, instead of the high.

Again, there's not a whole lot to work with here in terms of making more significantly divergent scenarios.

By now, I'm sure you've guessed where I'm going with this. You take two sets of similar projections, you feed them in the model, and the results are pretty much about what you would expect.

The overall preliminary, preliminary light duty vehicle stock scenarios stick to a rather narrow band and move in tandem, increasing 1.2 to 1.7 percent per year, to a range of 33 to 35 million, depending on the scenario.

Less than six percent separates the low and high cases in the out year. And since vehicle stock is a major component of vehicle miles and on to energy demand, you begin to see why the figures Ms. Strecker presented were, similarly, well, similar.

So then what are the consequences of this narrow range on the rest of the forecast? First, it means when it comes to class and fuel classes for forecasted vehicles, the three common scenarios become an exercise in slicing up pretty much the same pie.

If you see far more trucks or double the PAGV's in one scenario, compared to another, you're not going to be able to say, well, there's 10 million vehicles on the road so, of course, there's going to be a lot more.

Instead, we need to focus on how the other inputs affect matters. In the case of vehicle class that, for the most part, means looking at vehicle attributes.

However, as we stated earlier, time constraints necessitated the use of the 2013 attributes, and there

was only one set of those. So, this means the vehicle class distribution will be essentially identical for all scenarios.

The reference cases distribution is presented here and since the others are so similar, we can stick to this one. Cars and the various sport utility vehicle classes increase in the preliminary forecast, taking market share away from light duty trucks. Meanwhile vans, for the most part, hold on to their slice.

We've now covered vehicle stock and class. So, let's look at what we're all here for, fuel choice. As the vehicle attributes, in the preliminary forecast, are common to all cases, the burden is on differences in fuel prices to distinguish the common scenarios.

But before we get to that, let's do a very quick recap of some of the most important vehicle attributes, first, and then we'll look at the fuel prices. And once again, it needs to be stressed, these are the attributes from 2013 we're looking at. Moreover, they were produced for a forecast that used 2011 as a base year.

If you recall, that was the inaugural year of the Chevy Volt, the Nissan Leaf, and a year before, the Tesla Model S. So, there was little hard data on which to base these attributes, particularly in the EV and the fuel cell domains.

Of the 2015 attributes, some of them are already in staff's hands as of a week or two ago, and are undergoing internal review before they go into the models, while others should be received shortly.

Long story short, we're looking at yesterday's newspaper and these attributes will not be used in the final forecast.

Starting with compact car fuel efficiency, we see aesthetic increase across the board here, one to three percent, depending on fuel type.

Mid-size efficiency largely follows the same trajectory as compact cars, but tend to be somewhat less efficient, as one would expect. The odd kink in the fuel cell vehicles stem from a lack of a baseline data two years' ago. And staff have been assured that this has been adjusted in the 2015 attributes.

Turning to retail vehicle prices, we see newer technologies becoming cheaper as time goes on. Although, I need to caution that the EV price here, again, is anomalous and is corrected for 2015. Midsize cars, well, generally hold their price in nominal dollars.

Now, if you'll excuse me, I'd like to quickly skip ahead and give a sneak preview of the PEV stock, that is PSUV and EV together, to provide a bit of a

backdrop for the next slide.

As with total vehicle count, the difference in PEV stock in the three cases isn't huge. Even calling it ten percent would be rather generous. Given the other similarities we've seen today, that's really not much of a shock.

What's more surprising, however, is if you look closely, the low demand scenario actually sees higher PEV stock than in the reference case. On the face of it, that's a little counter intuitive. Even though there wasn't too much difference in total stock between the cases, there is still about a million total stock difference between then.

So, why would the reference case lose out here? To understand this, we need to look at the fuel prices, which is the last piece of the puzzle.

So, let's go back to slide 14 and figure this out. I've spent a lot of time today talking about the various similarities in our preliminary forecast. The econ demo common cases were very close. The attributes were kept constant. And the upshot is there isn't a whole lot to distinguish one common case from another up to this point.

The one case where there is a much greater difference is in the preliminary fuel price forecasts.

Now, Mr. van der Werf spoke at length about the preliminary fuel prices and proposed adjustments for the revised. But I'd like to point out one rather subtle item. I've plotted, here, just the gasoline and electricity forecasts for the reference and high price cases. Keeping in mind that high fuel prices correspond to low energy demands and a low demand common case uses both high gasoline and high electricity prices.

What's of note here is that when comparing the cases against each other, you see that in the high cases the gasoline prices ramped up much more quickly than the electricity prices. By 2026, gas prices are 33 percent higher in the reference case universe, versus just a ten percent difference for electricity.

Now, let's think about what this means for the PEV forecast we saw, where the low demand scenario sees more PEVs than in the reference. What we can do is, again, step away from the modeling perspective and back to those three questions. In fact, let's bring those back up.

And think on the micro, rather than the macro scale. In fact, let's focus on a single case. Somebody will call, we'll call her Mary. Mary's a young, single accountant, who makes $50,000 a year, and is in the reference case world. That is to say the median income,

state population, et cetera, match the reference case scenario.

One day she trades in her old clunker for a new car. She wanted a subcompact, so she got one, and was torn between gas powered or electric. She did the math. She's an accountant so, of course, she did the math. And found that the gas-powered car just edged out an otherwise equivalent EV on a cost-per-mile basis. And so she went with what her spread sheet told her to do.

As it happens, the day she bought her car it was groundhog day. And when she woke up, she realized she had to live the same day over again. Even worse, this time around she's no longer living in this reference case world, but now in the low demand one, with the higher fuel prices, but weaker economy.

Still, she perseveres and again has to look at trading in her old clunker. So, let's see what happens as she answers these three questions a second time.

First, does she need a car? The econ demo data, as we discussed, is pretty close to what it was in the reference case. Mary is almost certainly still single, and makes maybe a little less money, but not that much less. So, her answer probably doesn't change. She still needs a vehicle, but one is probably enough.

What kind of vehicle? Well, the attributes are

exactly the same in the low demand world. Mileage is no different here. They use the same Kelley Blue Book, and so on. If a subcompact suited her needs before, it should do just nicely here.

Finally, she has to decide on a fuel again. Let's go back to fuel. And now she has to contend with the higher fuel prices. Now, remember, she was on the fence before, but went with gas. But here, gas is a good, well, more than 30 percent higher. And while electricity is higher, too, it doesn't come out looking quite as bad as gasoline, relatively speaking.

So, suddenly, the EV looks more enticing, enough to push her over the edge. And so, she swaps out the ICE for the lithium ion and lives happily ever after. The end.

Now, let's apply this experience to the forecast. When comparing the low case to the reference, there's little difference in total stock and the class distribution remain mostly the same. But the relative shift in fuel prices means you're going to have cases, like Mary, for whom an alternative fuel choice will make more sense and ultimately driving demand for PEVs.

So, when we come back to our PEV forecast and look at this crossing over of the reference and low scenarios, I hope it's clear by now what it looks like

is going on.

In the high demand case fuel prices were low enough across the board to push everything up. However, the low demand scenario is boosted enough, again by people like Mary, making the economic choices, the economic choices of electric and plugin vehicles over gas. And so, we see higher PEV demand in the low energy demand case.

I've been talking about PHEVs and PEVs in aggregate. But real quick, I'd like to break down the split between the two in the preliminary forecast. You can see here that pure EVs total less than PHEVs throughout the forecast period, but their market share does increase up to around, oh, about half the PHEV total by 2026.

And the last chart, I promise, is another sneak preview of the forecast which will be presented in the July workshop, as part of the overall California Energy Demand Forecast.

Ms. Strecker showed a comparison of both of the two and, for the sake of completeness, here's the accompanying vehicle stock. We have an extremely narrow demand in TEFU's preliminary forecast, while the other cases take the opposite approach.

Again, the CEC folks will be discussing their

work in the July forecast, unless you have any questions on it now. I don't know if there's anybody in the room that can discuss it.

COMMISSIONER SCOTT: I do have a question.

MR. GAGE: Yes.

COMMISSIONER SCOTT: I'm trying to figure out how does this take into account the ZEV Mandate and other statewide policies? So, the presentation that we had earlier from Anna just showed a very different number of vehicles that are mandated to be here in California. And this doesn't appear to reflect that.

And so, I'm trying to figure out how to -- when -- this is the preliminary forecast.

MR. GAGE: Yes.

COMMISSIONER SCOTT: And so will you do an addition that starts to include some of the key mandates and policies, or how is that going to match up or come together, as you go from preliminary to the, I guess, draft forecast, or whatever the next step is?

MR. GAGE: I see. Well, our preliminary scenarios, we do not bake in the ZEV mandate. This is an econometric forecast that's based on what people choose to buy. You know, it's not based, obviously, on what manufacturers supply. And on that, yes, the ZEV mandate is not baked in.

The one exception is perhaps on the government level, where you might have seen a little bit of a jump there. You know, the ZEV Mandate does not dictate and tell people you are not allowed to buy and ICE. But on the government side, you know, that in theory can be the stroke of a pen.

As far as a scenario explicitly including the ZEV Mandate, I will have to get back to you on that. I think that's probably something we can do, but we will have to take a look at it.

MS. STRECKER: I think --

COMMISSIONER SCOTT: Oh, go ahead.

MS. STRECKER: This is Gene Strecker, again. In the attribute forecast, in the 2013 attribute forecast, the ZEV Mandate was included as a policy in the attribute forecast, which a contractor does for us.

So, that's where it's represented in our demand forecasts. But we plan to consider it, if we have enough time and, you know, if everything else that goes around with --

COMMISSIONER SCOTT: Well, I think we do need enough time to do that because that's a really important component of where the State is headed. And the number of vehicles impacts greatly, or has the potential to impact what the overall electricity forecast will look

like. And so, to leave that part out, I think we'll have an incomplete forecast at that point.

MS. STRECKER: Yeah, I mean, we can certainly have a discussion about what other, additional scenarios we can look at, and that certainly can be one of them.

COMMISSIONER MC ALLISTER: Yeah, I want to just build on that a little bit because I think this -- you know, given that it's early days and given that we're actively trying to build a market for these, it's kind of not in a vacuum. This is not -- you know, I think it's been said several times, in different presentations that people -- we're sort of taking, we're sort of trying to see -- you know, we're stuck kind of in today. We don't know what the future's going to be. And we're trying to sort of figure out what people want in their vehicles and build a forecast based on those probable choices.

So, I think the approach is, you know, I think it's definitely a valid way to do that and we ought to do that. I guess, if that approach, then, sort of indicates that based on our best judgment, and our modeler's best judgment, you know, on the choices people are likely to make, the technology mix we expect, et cetera, et cetera, we're going to find short of the mandate. Then we need to know that so we can work on

that to change the landscape.

So, I think this is an iterative kind of discussion where, you know, we're trying to actively shape the marketplace for vehicles. So, you know, is range still a factor? For example, like one question, is range still a factor in limiting the PEV marketplace?

So, probably, attitudes are going to change and we want to actively help them change in the directions that we need to get the policy goals right.

So, I'm trying to highlight the fact that it is so just incredibly critical that we keep active conversations with the right folks across the agencies, and sort of up and down all the different disciplines that we have here, at the Commission, to make sure that we're looking at this from lots of different directions, and the flags are coming up where they need to so we can work through these issues.

So, I'm not really implying that you're not doing any of that. I just want to make sure that we see the forest for the trees, and really keep an eye on what our policy goals are.

For example, in the building standards, I think we have a long, you know, kind of history of working directly with industry to try to get them to adopt new practices, develop new technologies. Because we have,

say for example, the Zero Net Energy goal that we really want to meet, right. And so, we try to build that collaboration with industry and really make clear that these are the goals and, by golly, we're going to meet them. And how are we going to do it most cost effectively?

And, you know, there are all sorts of co-benefits here that you could argue also, similarly, would exist in the transportation with air quality, and some of the land use and growth kinds of activities that are linked to transportation decisions.

So, anyway, sorry for the rambling observation. But I just think it's really critical that we keep an eye on all these pieces, even while we're working on one of them because they are really all linked.

MS. BAHREINIAN: This is Aniss Bahreinian. I'd just like to focus on the point that you see those three forecasts that we called CED forecast, 2015 forecast. Those have baked in ZEV Mandate compliance. Even the lowest of the forecast, which is the green line, shows that the minimum -- or that ZEV has been complied. Everything else is just exceeding that.

So, if you look a t the TEFU forecast, you can see that, certainly, to 2022, the TEFU forecast also exceeds ZEV numbers. That's important to point out.

When it comes to the PEV numbers. So, this is without fixing it to the ZEV Mandate, we have been able to do that. So, there's more hope in this thing than it meets the eye in the first instance.

COMMISSIONER MC ALLISTER: So, you said that the TEFU -- well, all the scenarios, which are sort of one upon the other there --

MS. BAHREINIAN: Yes.

COMMISSIONER MC ALLISTER: -- the high, reference and low. Those meet the mandate? I thought the mandate was higher than that.

MS. BAHREINIAN: Well, the green line at the bottom, which is the CED 2015, is meeting the ZEV Mandate. And since the other ones are higher than that, then they are meeting and exceeding the ZEV Mandate. This is only, strictly, with the PEVs. We are not speaking to FCVs.

COMMISSIONER MC ALLISTER: Okay. Does that make sense to you? The goal's a million, right, by 2020?

MS. BAHREINIAN: Yes, after 2021, then it becomes lower than the ZEV Mandate. But prior to that, it is exceeding it.

COMMISSIONER MC ALLISTER: Okay, and this is only PEVs, yeah.

COMMISSIONER SCOTT: Is it the total number of

cars each year or is that the total number altogether?

MR. GAGE: This is the total, the total stock on the road.

COMMISSIONER SCOTT: Okay.

MS. BAHREINIAN: Total stock of PEVs on the road.

COMMISSIONER SCOTT: Yeah.

MS. BAHREINIAN: I should also add that the ZEV Mandate relates to the new vehicle sales. And it is the percentage of the new vehicle sales that have to comply with XY&Z, all the requirements that are in the ZEV Mandate. This is on road vehicles, which is the stock of vehicles.

COMMISSIONER SCOTT: Yeah, okay.

MS. BAHREINIAN: So, they accumulate over time.

COMMISSIONER SCOTT: I will try to get a more detailed briefing from you all, on this, to really understand kind of what the assumptions are, and what's in here and what's not in here.

And I think my other question, which isn't related to the PEV stock, but was on the fuels, on the prediction on the fuels was how is the Low Carbon Fuel Standard in there? How is the Governor's State of the Union goal of 50 percent petroleum reduction in there?

So, I'd like to understand how those are

reflected within the scenarios. And I think I probably need to get a briefing so you can kind of walk me through, step by step, on how it's put together.

MS. BAHREINIAN: Absolutely.

COMMISSIONER SCOTT: Okay, thanks.

COMMISSIONER MC ALLISTER: So, I want to just make sure that we do our utmost to track the red or the blue line, you know, and try to not track the green line. Let's try to get the high, you know.

MR. KAVALEC: If I could add a couple more things, this is Chris Kavalec.

COMMISSIONER MC ALLISTER: Thanks, Chris.

MR. KAVALEC: We'll have to get together with the transportation folks because I think our compliance case shows substantially more stock than that. But we may be wrong. But we'll have to work that out.

COMMISSIONER MC ALLISTER: I think that's kind of the source of our questions, too, is what is compliance? What would we really expect compliance to look like and then map that over to the demand forecast for electricity.

MR. KAVALEC: Yeah, and it was based on the most recent, in 2013, the ARB most likely compliance scenario that Anna spoke about earlier. Which has been since updated.

So, assuming that we do one of our scenarios for the revised forecast, which is a most likely compliance scenario, it would look a little bit different because they've tweaked their ZEV Mandates in the last year.

The other thing I wanted to mention is that I know it's not -- given that California's committed to meeting the ZEV Mandates, and there's a lot of machinery and politics behind it, it's not prudent for us to be coming out with a forecast showing failure to meet the ZEV Mandate.

However, I do want to stress that I think there's a place for somewhere within our forecast, whether it's a scenario or a discussion, where we talk about what type of result you get when you predict the amount of electric vehicles using people's actual preferences, as measured by our survey.

So, maybe that's something we can talk about later about how, exactly, we would fold that in or present it. But I think it should be part of the information that we provide at some point.

COMMISSIONER MC ALLISTER: Yeah, and that's what I was trying to say before. I mean, I think this approach is absolutely valid. I mean, you know, attributes are real, people's decisions are real, and we live in a democracy and people can make the decisions

they want. And that's all good.

And I guess the flag that would go up is if we think that our expectations, that scenario of sort of what expectation looks like, in our best judgment, falls short of our goals, then we really need to know that. And I think it's very appropriate for a discussion.

But, you know, that discussion also needs to sort of project that we're committed to meeting the goals and how we're going to do aggressive, proactive policy to try to make that happen. So, I think all of the above needs to be in there.

COMMISSIONER SCOTT: I agree with that.

MR. KAVALEC: Okay.

MR. GAGE: So, switching back to the TEFU forecast. Where do we go from here? In terms of revised inputs, I've been focusing on three things today, econ demo data, attributes, and fuel prices.

I've been told we can expect some revision to the econ demo forecast later this summer, although I would not expect any wild departures from what staff currently have.

As far as attributes go, staff expects to have new attributes for each of the common cases.

Finally, fuel prices will switch to the revised forecast, which Mr. van der Werf explained earlier

today.

Beyond the raw input data, however, is what our staff believes to be needed to look beyond the common scenarios. These common scenarios are meant to be a set of baseline scenarios between the transportation, electricity, and natural gas forecasts to give a set of internally coherent, overall projections using a common set of assumptions.

However, there's nothing saying staff cannot explore alternative scenarios, as you mentioned, beyond the common ones.

For example, one can mix and match the price forecasts, taking a high price for gasoline, with the reference or low case for electricity to see how that would bolster EV demand.

Vehicle incentives are another area to explore, looking at when they expire, what happens if they are extended, increased, or even eliminated?

And this is where we would very much appreciate feedback, either today or in the docket. We would be interested in what sort of scenarios do you and members of the public would be interested in looking at.

And we are also calling for other sources exogenous forecasts, such as the econ demo data, which may be more bullish or bearish, depending on -- I mean,

than what we have used for our preliminary forecast.

In short, our preliminary forecast is just that, preliminary. Staff looks forward to making the necessary adjustments for the forecast, looking at these sort of what ifs, and seeing what happens to Mary come September.

And that, finally, is all I have. I'll take your questions at this time.

COMMISSIONER SCOTT: I asked all mine as you went along.

COMMISSIONER MC ALLISTER: Thanks a lot. I appreciate that.

MR. GAGE: Thank you.

COMMISSIONER MC ALLISTER: Other questions? Okay, thanks.

MS. RAITT: Thanks, Jesse. That concludes the presentations on the light duty vehicles. And now, we'll have Bob McBride on the preliminary forecast for the medium and heavy duty vehicles in California.

MR. MC BRIDE: Hi, Bob McBride, as we've said. Good morning Commissioners, stakeholders, staff. I'm here to present some preliminary results for the truck model, truck market share forecast component of our freight energy demand model.

I was just informed that model was called the

freight energy demand model at its outset by a consultant, or by somebody that was at the Energy Commission when it was developed, and is now a consultant I encountered.

We'll start by looking at similarities and differences between public and private fleets, some factors fleet managers consider as they decide what fuel types they choose when they purchase trucks.

Staff has used a truck choice model to generate truck market share forecasts by fuel type. Argon National Laboratory developed a truck model as part of a suite that uses their Vision Model. The model's been developed for DOE in 2012, and make use of the 2010 AEO high fuel price scenario. That's the current published results out of that model.

High fuel prices are paired, typically, to the economic conditions for low fuel demand. However, the preliminary truck fuel type market share forecast uses high oil price in all three demand cases. That's not by choice.

We emphasize a low demand scenario here. We'll look at out the revised 2015 fuel price forecast might shift the market share of fuel types for the revised forecast.

Last, I'll describe the updates planned for

that, the revised forecast.

Here's a rough comparison to help convey some of what motivates fleet managers. These are illustrative examples, not rigorous rules, and simplify many differences. In general, public fleets follow regulations and finances, while private fleets rely on the payback period. Incentives to meet statewide and regional air quality regulations have been applied earlier, more quickly to public fleets because there are special rules for that.

Ambitious public fleets may set the bar lower, perhaps trusting in a proof of concept or opportunities for subsidy when adopting innovative technology. Fuel price, operating costs, and interest rates are components of the payback period, which is the more important factor for the private fleet.

Commercial on road experience with a fuel type tends to be more important for private fleets.

At the request of DOE, the National Petroleum Council analyzed market prospects for alternative fuel vehicles alongside conventional fuel vehicles. This preliminary medium and heavy truck forecast uses data published in the 2012 NPC report.

We will be running 5.1, the current version, for the fuel type market share in the revised forecast.

Variation in truck counts arise from using the three common economic and demographic cases. Trucks of all fuel types are included. There is some variation.

A 2013 white paper, from America's Commercial Transportation, Inc., ACT, held that natural gas engines in heavy trucks is the diesel of tomorrow. However, in early 2015, ACT's new, and largely in response to the changing prices, fuel prices over the last year, ACT's new Natural Gas Quarterly featured this diagram.

Given the closing spread or ratio between natural gas and diesel, since 2010, and the high cost of natural gas vehicle equipment, current conditions favored diesel tech.

ACT now estimates the payback for a natural gas truck at over ten years. That can change, as we'll see. But it's a lot different than it looked three years ago.

The 2012 NPC report, DOE published results that are based on AEO 2010 fuel price forecasts. That's the second of about five times I'll say that. Using the high oil price scenario in the 2010 AEO, natural gas would be less than half the cost of diesel to do the same work.

The reference case shows the fuel price ratio around 60 percent. The low price, from the 2010 AEO, is nearly as expensive as -- natural gas is nearly as

expensive as diesel.

The high oil price scenario favors natural gas. The low oil price scenario favors diesel, with the reference case somewhere in between.

We'll discuss how more current fuel price forecasts play out in a few minutes.

This penetrated -- this is the fuel split of trucks. The penetration of natural gas trucks at the top of the bar, shown in light blue, represents the outcome of low demand economic conditions from the common scenarios, discussed in previous workshops, and the 2010 AEO high oil price forecast case, as it should.

The ratio of natural gas to diesel prices, the bottom line on slide seven, I'm going to leave it there for a second, drives this outcome. Some diesel electric hybrid trucks are already on the road, but first exceed 100 new units in 2019, given the fuel type market share in the NPC report forecast and looks very similar.

The same published 2012 truck fuel type share forecast, using the 2010 AEO high oil price, is used both in the high and the reference demand cases. The number of trucks is different.

The reference case will be revised to include a truck share forecast based on the 2015 reference case oil prices, as it should.

And the high demand case will be revised to include the truck fuel type share forecast outcome, using a 2015 low oil price.

The high crude price case plays out alongside the low demand common scenario in the freight model, with this outcome from combination tractor/trailers. Well, tractors. You're buying a tractor, you're borrowing a trailer.

For each forecast year, the demand for new trucks arising from economic conditions is satisfied with that year's market share for each fuel type.

Before diesel participate filters were required by the statewide truck rules, diesel refuse trucks exceeded Southern California's criteria pollutant standards, or EPS standards in Southern California. Natural gas fueled refuse and recycling trucks met the standards and were adopted locally.

Diesel fueled refuse trucks persist outside the non-attainment areas due to their low initial cost. Many of the same conditions applied to the urban buses and individually regulated fleets. And I might say the urban buses account for the lion's share of natural gas in the current fleet.

Now we turn to how we intend to update the preliminary forecast to reflect additional and current

information. All cases shown in this slide are based on reference price scenarios from different fuel price forecasts. AEO 2010 fuel prices, shown in green, were used in the published NPC report. In the reference case, natural gas costs 60 percent to 70 percent of diesel when applied to carry equivalent ten miles.

We plan to apply the AEO 2015 fuel prices to the interstate truck fleet because that's a national concern, and the CEC 2015 fuel prices to all other trucks in state. Therefore, we expect market share in the revised forecast to be less favorable to natural gas truck purchases than in this preliminary forecast. And we'll see how much in a few minutes.

Or right now. Here, the fuel type market share for new diesel trucks is shown in red, with new natural gas trucks shown in blue. The solid lines represent market share of new combination tractors, that's the articulated ones. The dashed lines represent fuel type market share for heavy single unit or the unarticulated ones.

And why are they different? The tractor, the long-haul tractor trailers go more miles in a year, so they are able to overcome the initial high cost of the natural gas truck better. Many hours of operation are required for the natural gas trucks to overcome their

high initial cost.

Interstate combination tractors, tractor trailers that can cover 80,000 to 100,000 miles a year, some of the in state ones are maybe 40,000 to 60,000.

Not the windows for natural gas truck market share in 2008, 2011, and 2012. We interpret this as an unrealized opportunity. Uncertain future conditions, limited fueling infrastructure, maybe less efficient engines may have played a part in the low natural gas truck sales to private firms through these years, despite this graph.

Starting in 2013, this scenario calls for very low -- oh, I'm sorry, where am I? Yeah, starting in 2013, natural gas adoption looks pretty low for about five years and then starts to creep back in.

Low oil and, hence diesel prices, will likely dampen adoption of heavy natural gas trucks throughout the forecast. With diesel prices so low, the high initial cost of a natural gas truck is a solid barrier.

So, staff plans to update fuel prices and vehicle prices, both influential in the truck forecast. The 2014 data will be substituted in where we've used 2011 data. Staff will run the truck 5.1 model, with updated inputs and produce revised truck fuel type market share cases for each truck class. And I have

about eight classes. So, we have a little bit of resolution there.

These truck fuel type market share forecasts will be used in the freight energy demand model for the revised fuel demand forecast.

And I'd like to hear comments and questions now, please.

COMMISSIONER SCOTT: On your market share using the high oil prices and the low oil prices, those oil prices are coming from the slides that we saw previously, that I think Ysbrand presented or where -- does that match up?

MR. MC BRIDE: Okay, these two graphs I put the -- our fuel price forecast in the model and ran it, as an alternative to the published results. The published results were all the 2010 AEO.

COMMISSIONER SCOTT: I see, okay.

MR. MC BRIDE: So that's where that -- everything basically before this slide. And, you know, a lot demands on this right here. We're on the green line in the published results. And depending upon whether you're an interstate truck, or somebody in California, you're on one of the other lines.

COMMISSIONER SCOTT: Okay, thanks.

MR. MC BRIDE: I'm happy to hear comments when

you're ready to send them. Thank you.

COMMISSIONER MC ALLISTER: Thanks very much, Bob.

MR. MC BRIDE: Thanks.

MS. RAITT: Thank you, Bob.

Now, we'll move on to other vehicle types, and Gordon Schremp on the Preliminary Aviation Fuel Demand.

MR. SCHREMP: Good morning, again. Gordon Schremp for a second session. You might see me a third time up here.

So, we've been sticking to the ground so far and we're going to now take it to the air. There is another transportation means and that is aviation, certainly. And so, we do look at aviation fuels, both in terms of historical consumption, as well as forecasted consumption or demand.

So, some of these slides are a little bit of a review, but I want to go back over them. It's important for the context of my showing of the preliminary forecast for California fuel demand for aviation.

So, basically, there are different types of aviation and I'll talk about those. There's an approach to forecasting fuel that's based, basically, on passenger, load factors, and where you're going, domestic or international destinations. And I'll cover

what those forecasts do look like, the results of the past years and the fuel consumption.

So, the different types of aviation fuels, aviation gasoline. It's basically like gasoline, higher octane, a very small quantity, less than one percent of aviation fuels.

Military jet fuel, which is two different versions depending if you're a naval craft or all other military craft. And that actually is something that's going to be changing. The military is trying to go to a fuel specification, or they actually are. Have been changing late last year and this year to using commercial jet fuel, essentially. So, that's going to, I think, make ease of acquisition and availability for both domestic and international acquisitions of the fuel.

And so, but how we have examined military jet fuel is we actually construct demand based on data from solicitations by military facilities. And so, that's a rather labor intensive process. So, it will be better going forward not to have to differentiate. But still, going forward, jet fuel will then have a component that is actually military, in the commercial jet A category. And that's about anywhere eight to ten percent of total.

And as I mentioned, the State Board of

Equalization does have fuel data available. People go look at their information online. But once again, it's taxable sales. So, yes, you can see jet fuel taxable sales, and they will be a very, very small percentage of total. Because in-plane fueling, or in-wing fueling, like Southwest Airlines, that they do on the tarmac, is not assessed a tax. So, you don't see that in BOE data. It's only private jets, at some commercial airports, that actually have this sort of tax paid on the jet fuel going to those planes. Very small quantities.

So, as I mentioned, aviation gasoline is very small. That's why it's a red color so it can actually show up on the bottom of this slide.

But this is mainly commercial jet fuel. And like gasoline, like diesel in the near term slides, you see a very similar pattern of a decline. You know, 2007, 2008, the big recession did hit jet commercial traffic in the United States, the West Coast, California internationally for that matter. But there's been a steady recovery after that fact.

And military jet fuel, that green line moves around a little bit, but is pretty consistent. Absent some sort of war footing in the home country here, you do see sort of a stable level of demand for military activities, exercises, et cetera, training of pilots.

And so, that's going to be a rather steady quantity for California.

So, what approach do we use? You know, you've been hearing about the modeling work they've done, the vehicle attributes, the local prices, and it all goes into the demand forecasting from the Transportation Energy Office so -- or in our Energy Assessments Division, now.

So, we don't do that with the jet fuel. And we certainly don't look at aviation gasoline because it's a very small component of overall transportation fuel.

So, we look at, instead, other attributes or factors that drive consumption of jet fuel, and that's the number of people. And, basically, the fuel consumption per in-plane passenger, that's based on load factor of the plan, the type of aircraft, as well as, certainly, the distance flown. And what kind of fuel efficiency is being added to jet fuel choice. You know, whether that's Boeing or air buses producing and selling.

So, it's all about improved efficiency because that is the number one cost to the commercial jet industry is the fuel cost to their bottom line. So, it is very important to that industry how efficient the aircraft are and, certainly, what load factor you can

get up to, very high load factor to reduce their per-plane cost.

So, this aviation information does have a lot of data from BTS, historical data. And we do look at that because we want to look at the relationships that are developed between passenger activity, cargo activity and fuel consumption.

So, we have fuel consumption for California, but we don't have fuel consumption by individual airport. But we do have the amount of in-plane passenger and cargo activity by individual airports.

So, we've looked at all that on a historical basis and we come up with these fuel consumption relationships.

So going forward we want to say, because FAA shows fuel consumption forecast nationally, they do not show fuel consumption forecast on a state-by-state basis, but they do in-plane forecasts by individual airports all throughout the United States.

So, we look at what those national relationships are, the split between domestic destinations and international. And, certainly, if you have international destinations, you're consumption per in-plane passenger will be greater because you're going a greater distance.

So, we look at those national trends and we see where California fits in historically, and we follow a similar relationship going forward to California. Meaning, you know, improvement in fuel economy overall and similar load factors moving forward.

So, this rather busy chart is both historical data for in-plane passengers boarding aircraft, as well as forecast data. So you do see there is, as Commissioner McAllister was mentioning before, we have these straight lines historically. They do move around for a variety of reasons, but the forecasts end up being some sort of straight trend line, usually.

So, FAA is forecasting, with their sole forecast, a growth in in-plane passenger, you know, a rather brisk business, if you will. And you can see, with these red highlighted numbers, you look at what the compound annual growth rates are and they're up a little bit moving forward to the historical period presented in this chart. About 1.5 percent, per year, over the forecast period.

If you look at what the international change is, it's very small, but still from one historical period, the forecast period, but much greater than domestic. So, international traffic is sort of growing like gangbusters, but a smaller part of the overall total.

And so, then you look at what that combined total is and this, of course, is for the United States.

So, now, we'll shift gears and we'll take a look at California in-plane passengers, historically moves around like the U.S. totals, and then rising over time. So, clearly, we're already at a historically high in-plane passenger total right now, on the historical basis, and we'll go nowhere but up from there, absent real world changes that will occur, but it cannot be precisely predicted, as Commissioner McAllister pointed out.

So, the growth rate here is different here than that of the national perspective. It actually goes down a little bit on an annual basis. It's about 2.5 percent, per year, over the forecast period, rather than 2.65. So, the rates are similar, but a little lower, not going up a little bit higher. And this, of course, is what a combined passenger in-planning, a mixture of domestic and international, yet we can't see what that mix is because that data is not broken out in the FAA forecast data.

So then we look at what's the fuel consumption per in-plane passenger? We do recognize that there is certainly cargo activity consuming fuel in those planes and they have very few passengers. So, the assumption

is that whatever that mixture is of cargo and passenger plane activity for the U.S. is similar for that of California, although we have no way of determining whether that is actually true or not over the forecast period.

So, what you can see here for California, the green is somewhere a little bit higher. We have an average of about -- you know, it started off at over 40 gallons per in-plane passenger. Certainly, higher than the U.S. average and why is that? We have a higher percentage of international destinations for people boarding aircraft in this State, than the U.S. average.

I'm sure if we looked at, say, the State of Florida, you would see something like that, a higher in-plane passenger fuel consumption in that state because of a greater concentration of international destinations.

So, the one other takeaway, besides that, is rather flat, if not declining. And yes, declining. So, there is a continued improvement or a decrease in fuel consumption per in-plane passenger because of the fuel economy technologies, engine technologies, drag reduction design of aircraft technologies. And even route selection and how close you're allowing planes to fly in similar corridors.

So, all of that is reducing the amount of fuel, so it's being used more efficiently as time goes by.

So, we put that together with the in-plane passenger, the assumptions on the relationship on the fuel consumption per passenger, and we end up with this projection, a sole projection for fuel consumption for jet A over the forecast period which is lower than it has been in the historical period, of 2.4 percent per year. It's now 2.1 percent per year growth rate over this entire period.

And that's all I have for the off-the-ground demand forecast information. I'd be happy to answer any questions you have.

COMMISSIONER MC ALLISTER: Good. Nice job, thanks.

MR. SCHREMP: Thank you.

MS. RAITT: Thanks. Next is Jesse Gage on the high speed rail.

MR. GAGE: Thank you. My HSR presentation is going to be very short and mercifully sweet. So, let's get right into it.

When staff first presented the plan for forecasting high speed rail fuel demand, back in March, there was this rather cumbersome algorithm for its computation, using the High Speed Rail Authority's

ridership and load share diversion forecast, rail segment length and other factors.

Staff also mentioned that the proposed algorithm was provisional and subject to change based on the exact forecast information received from the California High Speed Rail Authority. And it's a good thing that was said, as staff has come up with a markedly simplified algorithm this go-around.

Step one, Cal HSR literally sent their energy consumption forecast for high speed rail for 2026.

Step two, we used it.

(Laughter)

MR. GAGE: As it happens, the good folks at the California High Speed Rail Authority pretty much did staff's homework for them, and provided the energy forecast they produced in support of their own 2014 business plan, which is used here, at their request.

As was stated in March, high speed rail is scheduled to begin operations in 2022, with an initial operating section stretching from Merced to the San Fernando Valley.

Their business plan expects ridership to increase from around 5 million in its inaugural year, to nearly 13 million in the out year, with electricity consumption increasing from about 190 to 362 million

kilowatt hours.

And as a quick hat tip, this information was provided by Boris Lipkin and Meg Cederoth, of the California High Speed Rail Authority. Meg and Boris, if you're listening to this on WebEx, thank you.

Any questions?

CHAIR WEISENMILLER: Yeah, this is Bob Weisenmiller. One of the things we wanted to understand is that we've got high speed rail, we have some existing train network. And, certainly, one of the things is high speed rail is part of that package looking at upgrades to Caltrans in the Bay Area, and potentially upgrades in Los Angeles.

So, do we look at anything aside from high speed rail, and/or those pieces of high speed rail?

MR. GAGE: With the high speed rail, itself, no, we're looking specifically at the high speed rail all by itself.

As far as rail and other things that is, I think, considered as part of our other forecast models, yes.

COMMISSIONER MC ALLISTER: So, the diesel, just to be explicit, the diesel forecast includes rail?

MR. GAGE: Yes, it absolutely does.

COMMISSIONER MC ALLISTER: Okay, thanks. Thanks

very much.

MR. GAGE: Thank you.

MS. RAITT: And, finally, we'll hear from Gordon Schremp, again.

COMMISSIONER MC ALLISTER: Wow, the trifecta.

MR. SCHREMP: Gordon Schremp, with the Energy Assessments Office, again.

No slides, so a round of applause for that. And I'm the last presenter before we get to questions from interested stakeholders.

So, let's do a little review, if we will, of what we've heard. And so, I think the watch word for this morning is "preliminary". Yes, I think we all sort of got that message.

More work needs to be done and more work will be done until we present, again, in advance of our next workshop, which will be sometime this fall. So we'll be, I think, coming up with a date sometime in the near future and telegraphing that to everybody.

So, we're seeing that clearly, when we did the work before, as Ysbrand was pointing out, we based a lot of -- certainly, a lot of that on what the Energy Information Administration does, and at the mercy of their release or late release schedule, because they're busy people, also.

So, we will, as Ysbrand has already gone over some of that data and has shown you a little preview of what the changes are and they can be significant. And what he was also mentioning is they do a revision to what they've done.

2015, early on, there's certainly a lot of uncertainty, as Commissioner McAllister pointed out. We have a lot of volatility, still. And we're seeing how all those oil prices are starting to converge.

And as Ysbrand was pointing out, yes, we're starting to see impact on crude oil production domestically. It is starting to plateau and decline in North Dakota. So, it does seem to be having an impact.

This is what, certainly OPEC, in principle, Saudi Arabia has been looking for, and the market participants that set these global prices by supply and demand, and what their outlook is.

So, that is having an impact. We, in fact, will preview, we will be having a workshop on July 20th to talk about changing trends in crude oil, which we'll be talking and updating people about what's been going on since the workshop we conducted on this topic last summer.

So, that's important. So, we'll be looking at those updates by EIA that come on a quarterly basis, the

Short Term Energy Outlook, or if they actually do an update of what they released. Sometimes they do an amended version that comes out. So, we would want to incorporate those recent changes, especially in the near term. Because we recognize we come back to the IEPR process every two years, we get another bite of that apple.

So, the near term outlook is very important and so, especially in an area that has a lot of volatility and recent change. We're looking for, as Ysbrand pointed out, some convergence on that wide disparity over the near term. So, we hope to do that.

In the hydrogen arena, I think we were hearing that there will be some changes to that. More data is coming in from the programs that the Commission is helping to support. And we'll expect to utilize that information.

Ysbrand was showing you a lot of the detail he used in his H2FAST model. And so, we want to make sure we're incorporating some of the additional information to see how some of those cost component and breakdowns do change and, you know, are we actually seeing some movement away.

And some of the questions from the dais were, you know, is there room for improvement in some of these

areas or are they very narrow changes? So, that's real world information. We think that's very important.

But, as I think many people commented on, it's early and a very small sample size, a lot to do here.

So, we will be coming back with some changes in that arena and don't know how significant they may be, or not.

Certainly, the vehicle attributes are going to be updated. And that, as Jesse Gage was pointing out, and that may cause a shift that's going to be noticeable. We'll soon see. But that will be some of the change you can expect in our next workshop.

And the same goes for prices, the annual energy outlook. You saw that those prices are different, as Bob McBride was pointing out. And not such a large differential, but these, a little more of a convergence, now, in those prices because of the rapid decline of global crude oil prices have brought them closer together.

Although, it's fair to say that the natural gas price outlook for North America is rather low for a, probably, rather significant period of time.

The resource base is pretty robust, even with the most recent update by EIA, and the outlook is quite good for natural gas supply. Albeit, with some LNG

export capability starting up next month, in Louisiana, I believe, and a couple of other facilities down the road. But in the grand scheme of total natural gas, it's rather small, modest right now.

And other projects, possibly on the West Coast of Canada, have yet to be finalized, whittled down to a few proponents. And so, we'll see how that plays out.

At the same time, a backdrop of some significant liquefied natural gas supply coming on line in, say, the Gorgon project off of the coast of Western Australia. There's some large natural gas suppliers coming online for liquefied natural gas. So, that's a changing dynamic, but looks like we're pretty low prices here.

So, what's going to happen to diesel prices? A rebound, with a rebound in oil prices to create more of a separation than we've seen with the convergence. So, we'll circle back with some of that.

And we also heard about we expect to see an update on vehicle cost that we'll be looking at, and seeing how that might change some of the most current information we have.

And what's important, you were seeing a combination of what we had released and "published", you know, figures available, and then when we've already been contained to do analysis, and showing you sneak

previews of what that looks like, and where it really changes some of the initial results.

So, clearly, all of that information, as shown here today, as well as additional modifications will be new, published information in advance of the next workshop. So, you'll be seeing and everyone will be seeing those numbers.

And I think Commissioner Scott was -- certainly wants some additional information on hydrogen and we will be happy to accommodate.

And also, to talk about something else that we haven't discussed yet, here today, is sort of that post-prospect aspect of our analysis. Do we model the Federal Reform Fuel Standard? Do we model the Low Carbon Fuel Standard as part of the transportation demand modeling?

No, we do not. We do what's referred to by ourselves, and others, as post-processing. So, we take that forecast of demand and then we examine it for compliance with the Renewable Fuel Standard. So the Renewable Fuel Standard, or RFS, is Federal compliance. California is, say, 10, 11 percent of the gasoline. So, we look at proportional share of biodiesel, ethanol advanced biofuels.

And so, are we seeing in our preliminary

forecast or revised forecast for California sufficient quantities of those fuels. And if we don't see those for post-processing purposes, we'll go in and sort of force and show compliance with that.

And with California doing ten percent of ethanol in gasoline, we didn't seem to have a problem with total ethanol. We understand USEPA has released, finally, what the 2014 requirements are. Yeah, I said 2014 requirements. So, those are now out and those are sort of what happened are the requirements.

2015 has some new targets for biodiesel, higher than expected, advanced biofuels a little bit higher. And traditional ethanol down a little bit. And for 2016.

So, it looks like they're trying to still make sure that there's not a breach of what we call the gasoline blend wall, ten percent ethanol and gasoline. Albeit a recognition some E15 stations, a little over a hundred or more in the United States, out of over a hundred thousand retail stations and, you know, over 150 million gallons a year of E85, 11 of it in California last year. So, E85 is going to be going up and can get more ethanol into gasoline through those means.

So, we've been looking at the Renewable Fuel Standard, those changes, and we'll be making assumptions

that going forward that we're sort of keeping with the gasoline, you know, ethanol blend wall at ten percent.

So, the most interesting aspect of the post-processing comes to bear with the Low Carbon Fuel Standard. And so, really, how the Low Carbon Fuel Standard alters our examination is we burrow down and look at, we say, okay, given the assumption that ten percent of gasoline is going to be ethanol, now where does the ethanol come from.

So, it's not going to be all corn-based ethanol because one doesn't want to use that for LCFS compliance. One would prefer to use more advanced, lower carbon-intensity ethanol. So, where does that come from? That comes from Brazil. That comes from cellulosic fuels, to the extent they're available. And that comes from advanced technologies deployed even in California facilities, using different types of feedstock, besides corn, that lowers the carbon intensity, using corn oil.

So, there are all of these kinds of things that are being done, tracked by the Air Resources Board in those compliance pathways, and in their published data of actually what's utilized, the different tranches of carbon intensity of ethanol.

So, we want to make sure that we look at the

ethanol being used and see how that sort of fits in. But it's not just simply looking at the ethanol because it's all advanced biofuels, and hydrogen use, and natural gas use that all go into generation of carbon credits that can go towards offsetting the carbon debt, each year going forward.

So, we will also look at the amount of natural gas being used from those sources. And we'll be looking at the biodiesel.

So, the Renewable Fuel Standard regulation, they're indifferent to how biodiesel is created. You can use soy, and it complies with that standard, but not under the Low Carbon Fuel Standard. That's a higher carbon intensity feedstock to create biodiesel.

One wants to use cooking oil as a source. But we recognize, you know, there's some limitation on that feedstock.

One also wants to create and utilize renewable diesel which we're seeing, as I mentioned, as almost a doubling, compared to the biodiesel used in California last year, of renewable diesel. And that's a much lower carbon intensity fuel.

Also, some feedstock limitations for renewable diesel production in the United States and internationally. But where would it come, when it comes

into the United States? We believe it would be preferentially directed to go to California because of the Low Carbon Fuel Standard. That's why it would want to come here.

Further down the road we expect to see some more advances in renewable gasoline production. Gasoline molecules are the same, just a renewable feedstock is used, rather than crude oil, to create them. That's a really good, low carbon intensity fuel.

So, there's lots of activity in that space to learning on a pilot scale, and in near commercial scale production. So, we expect progress to be made in that area and that fuel becoming available to be preferential here.

So, part of that examination is to see sort of what is available, currently, what is sort of under construction. And then, you know, what additional supply might need to be made available.

And so, I think one of the comments Commissioner McAllister was making earlier about, yeah, we have these goals and we certainly want to achieve these goals, you know, petroleum reduction, and penetration of these ZEV mandates. But we also want to be aware of what the market is showing us, historical, actual preferences, actual purchases, actual choices, and actual utilization

of fuels. So, how close, how beyond the target are you already going on an early level, over-complying or maybe lagging behind because that's very instructive to where one wants to end up with regard to some of these policies.

So, we think the post-processing does provide some information in that arena that looks like, oh, there's plenty of this kind of fuel, that's pretty good. We think there's more than could come in. Or, this area maybe is lagging a little bit.

And I think you see a recognition of that by what USEPA did with regard to cellulosic biofuel targets and how those have been dramatically reduced based on progress to date has been slower than Congress envisioned back in 2006. But, you know, a lot of work is being done, new facilities are coming online now, later this year, early next year. So, we're going to see some commercial scale production of cellulosic biofuels.

And then, like any other startup technology, many lessons learned and many lessons deployed moving forward.

COMMISSIONER MC ALLISTER: Yeah, so great. I totally agree with your train here. And, particularly, like in the cellulosic ethanol example, you know, it's

a -- seeing how the marketplace didn't really get there, as expected in 2006 and 2007. You know, there was a lot of academic research going on, on this, and I think that enabled insights in the near term that enabled them, you know, the Federal Government, to fund research a little bit differently, maybe more. And kind of really double down on the effort to develop processes and scale them.

And we, fortunately, have the opportunity in California to do that, too. Because, you know, Commissioner Scott oversees this grant program to build out all the various infrastructures we need. And so to the extent that you, in your investigation underpinning the forecast can come up with, hey, you know, we see things kind of going over this way with -- you know, with plugin hybrids, or fuel cell vehicles, or hear something that is a gap in the marketplace that we really didn't see, but not is becoming apparent, we need to know that so that the staff running those RFPs, and kind of putting out program opportunity notices for grant money can build that in to the way they do business.

So, I think that this ecosystem is something we really need to nurture because we're doing something super important here. And the forecast is really a key component of all that.

So, I know you're very networked and the staff is working hard on this, so I just want to sort of keep that idea in everybody's head as we do our particular pieces that it is part of the bigger whole.

But thanks for the context, it's really helpful.

MS. RAITT: All right, so we're ready to move on to public comment. I actually don't have any blue cards, but we'll go ahead and take people.

MR. CARMICHAEL: Sorry, I didn't realize you wanted blue cards, but I'll turn one in. Tim Carmichael, with the California Natural Gas Vehicle Coalition. Good morning.

First of all, thank you to the staff. I appreciated the presentations very much. Especially appreciated the summary at the end there, by Gordon. I thought the big picture view, tying a lot of these different pieces together was very helpful.

I think it's great that the Energy Commission, at least this is my perception from the outside, it's great that the Energy Commission developed separate analyses in different groups, and projections for this preliminary discussion or presentation.

But to me, there were some disconnects. And I think one of the next steps for the agency is to try and reconcile some of these different projections.

And I just want to mention a couple of them that I think are worth looking into. In the opening presentation, the summary of where things are going, there's a slide about natural gas transportation energy consumption, slide four.

We actually think these numbers are a little bit low. You know, my disclaimer is I get paid to believe these numbers are low. But even if we take these as truth or, you know, as accurate as best as we can see, there's a disconnect between these numbers, especially in the out years, and the presentation about likely vehicle mix for heavy duty trucks, let's say.

And you look at the percentage of natural gas trucks projected versus how much fuel is being anticipated to be consumed, unless there's a piece that wasn't discussed that a lot of this is going to be in marine vessels or locomotives, which is possible. But I don't think that was part of the vision here. And if it is, we would love to talk about that.

So, I think there's a need to connect those dots a little bit between truck projections, which I think is going to be the primary consumer of natural gas over the next decade, and the fuel consumption projections.

I'm also interested in following up with the staff on the current consumption numbers for natural

gas. Again, just that same slide four, it looks like about 150, 160 million gasoline gallon equivalents of natural gas. I'm curious on what CEC's sources are on that?

We've had some recent discussions among our members, and with some of our consultants, where there has been this assumption for the last couple of years that the LCFS was our best marker for how much natural gas was being consumed in transportation.

What we've found in recent discussions is there may be a bigger gap than we thought between how many LCFS credits are being applied for and generated, and how much natural gas is actually being used in the transportation fuel.

We previously thought there was a very small gap there, but we now think there's a bigger gap.

And I'd love to talk with the staff more about their sources versus the LCFS and some other inputs that we had from our members.

If I could make one quick point --

COMMISSIONER MC ALLISTER: Yeah, go ahead.

MR. CARMICHAEL: -- on slide 10 of Mr. van der Werf's presentation, 10 and 20, I guess. Sorry, let me just get that.

So, I think slide 20 can't be right. And the

reason I think slide 20, and this is a high energy price case summary in Mr. van der Werf's presentation. The reason I think that is because if you look at the preliminary projections from the staff, I think that's what's projected here.

But I was following the presentation to say that with the new EIA data and, yes, there's more uncertainty, but there's a much higher projection for the high price scenario. That's not reflected here, I don't believe. And I just want to flag that as something that needs to -- I'm focused on diesel in this case. I think that's something that just needs to have a second look and see if, in fact, that new EIA data is in fact captured here. Because it appears to be consistent with the preliminary projections from staff, but not the EIA update.

So, that's it for today and look forward to following up with the staff one-on-one, or in small groups, to share some more information. Thank you, again.

COMMISSIONER MC ALLISTER: Thanks for being here.

MR. HELLER: Miles Heller with Tesoro. I violated the blue card rule, too. But I thought I was only going to come here and be a sponge, and listen to a

lot of good information. And I did that.

But there was a really important conversation here that I want to emphasize. And I was glad, in Gordon's closing, that he emphasized it, too.

It is really important, as I think Commissioner Scott, you said, that you understand what the outlook is should all of the policies in the State be accomplished. Because it's important to know what that electricity demand, for example, with a high level of EV update is, what the infrastructure needs are there, absolutely.

It's also very important to understand if the staff has data that suggests that those goals may not be met. And I think, Commissioner McAllister, you said it's very important because you may want to make policy adjustments in order to get those goals back on track. I totally agree with that.

So, it's very important for you, but I think it's also very important for us in the regulated community to understand those relationships, as well.

So, for example on, you know, if EV uptake -- I think the Governor's goal is 1.5 million by 2025. If the EV uptake is not that high, obviously that can affect the gasoline demand outlook.

If the gasoline demand outlook is lower than LCFS compliance, it's actually easier because less

deficits are generated and in fact more EV credits would presumably be available.

If that uptake is not as high as expected, then the LCFS will be more difficult to comply with.

And it's important to understand those sensitivities. And I think your staff has the best data and the best capabilities to put that information out there, even if it is presented as a scenario that, you know, obviously falls short of whatever regulatory and policy goals exist out there. It's important to have that information on the table and understand what that is.

So, I just really want to emphasize the significance of this conversation. And I want to make sure that in this IEPR process all of that information is presented.

The last couple cycles, it's felt a little bit insular in that the LCFS compliance scenarios say, well, we rely in part on CEC data. The CEC says, well, okay, well, we assume the LCFS is complied with.

I think it's important to have the conversation if not all of the data presented reflects that. Thank you.

COMMISSIONER MC ALLISTER: Thanks very much. And I wanted to -- you know, I'm kind of in the position

where I'm not the lead Commissioner on this issue, and so I probably have an in complete and spotty view of this. So, those of you who are really embedded in it full time, you know, have a better sense of this than I do, certainly.

But I guess, you know, lately I've been thinking more about the EVs and to get adoption, what is needed? And it's really important in that respect to know how people use them and what they expect out of their car.

You know, we sort of have this vague assumption that, well, people take long trips, if people take long trips in their car -- then, if people take long trips, then maybe they're not going to get an EV.

But, you know, let's unpack that and see, and how might that feed back into our charging infrastructure discussion or, you know, the kind of sense of what range is the optimal in terms of cost versus benefit.

So, one example, right, of issues that we need to dig into and maybe, I'm sure there are many, many people who know more about this than I do. But basing it on that kind of informed understanding I think is really key to balancing all of these different sectors and kind of getting, you know, optimizing this whole modeling approach and getting the tradeoffs right.

So, I appreciate your support of that. Okay, thanks.

MR. TUTT: Good morning. Tim Tutt from Sacramento Municipal Utility District.

And I just wanted to ask about the electricity price forecast or information in the presentations I've seen today. As you guys know, I drive an electric vehicle and I have for a long time.

My off-peak rate for charging my car in Davis is six and a half cents a kilowatt hour. And at SMUD, I can charge for an unlimited amount for $10 a month, basically. And I figure that equals out to about eight cents to ten cents a kilowatt hour.

I don't see how that translates into $5 per gallon equivalent for electricity. And even if, you know, you use more normal electricity rates, like 15 cents, or 20 cents, or high tier of 30 cents, it doesn't seem to translate into that, to me.

And I suspect that it's just an MMBtu or some kind of equivalent transfer of standard electricity cost into a gallon of energy. And that the efficiency of the vehicles, since there's no combustion in the vehicle, tends to offset that in the final analysis.

But I wonder if it's important, in terms of how these attributes are used? There's a -- I know there's

a vehicle choice model. And when you present consumers who are used to paying, you know, looking at $2.50 to $4.00 a gallon of gasoline, a number that's higher than that, I would think that they would tend to discredit that without necessarily accounting for the efficiency differences.

And so, I just wonder if it affects the vehicle choices when it's modeled this way and actually, kind of where the modeling even comes from in terms of how that price gets there.

I also wanted to -- in the car price assumptions, it seemed like in one graph the battery electric vehicle prices were highest and in another graph the diesel prices were highest. And I wondered if that was sort of a flip, in some fashion, in the legends?

Also wonder if the battery electric vehicle prices that are assumed reflect the values of the Federal Tax Credits in the State rebates, or are they just the standard vehicle prices? Again, important for consumer choice modeling.

If you present them with the, you know, the factory price versus the final price that they see, it's different.

And then in terms of, again, that modeling, I

know there's a standard set of attributes. But one of the attributes that, as an electric vehicle driver, I find important is just the convenience of having a fueling station in my home, and a fueling station at my job, and not having to spend time during my day to stop and go to fueling stations.

And I don't see, I don't think in these vehicle choice modeling or surveys that you can pull in those attributes very easily. I think there might have to be some post-processing to reflect those kinds of things.

COMMISSIONER MC ALLISTER: Yeah.

MR. TUTT: And one of the things I would suggest, and I don't see it here, maybe it's going to come is we have a rich history, now, of four or five years, or longer, on electric vehicle uptake. And some idea of taking the modeling -- or the model that you get and calibrating it to history, and then reflecting that calibrated forecast going forward would be important. Thank you.

COMMISSIONER MC ALLISTER: Those are a great set of comments, Tim, thank you very much.

And I agree there are a bunch of -- you brought up a lot of issues, but the two that I wanted to highlight are rates. And it sounds like you're on, you know, an EV rate, or time of use of some sort, and you

do have that differential pricing. And, hopefully, we're getting some understanding of what the, you know, elasticity of demand is in this space, right. And so, do people actually think about the cost of electricity and does that influence their purchasing behavior. And I think it probably does in some way, but we need to understand that more.

And what was the other, the first issue that you brought up, which I'm just spacing on, but maybe it will occur to me. So, there's rates and there was one other issue.

Anyway, I'll let Aniss go ahead.

MS. BAHREINIAN: Just a clarification. You absolutely have a good point, Tim. And we do, actually, account for not the price of gasoline, but actually the cost of driving. So, we do incorporate both the efficiency of the vehicles, as well as the fuel prices.

So, what our consumers see is actually the cost of driving. Sorry, what our consumers see actually is the cost per mile. That's what they see, which is a combination of the efficiency and fuel prices.

The other point that you made regarding the convenience, yes, we also account for that. And the way we account for that is time to fueling station. So, obviously, if somebody is fueling at home, time to

fueling station is zero.

But if somebody is driving to a fueling station, then it is going to take 5 minutes, 10 minutes, 15 minutes to drive to the station. So, we do account for those two factors, at least, both in the survey and in the model.

COMMISSIONER MC ALLISTER: Great, thank you.

I remembered what the other point I wanted to make was. So, I totally agree, we've got several years, a number of years of uptake now, and we can understand this market better. And totally agree with your calibration point, as well.

And I actually noticed, just on a whim I looked at the -- did a few searches on used EVs and there is actually a pretty robust marketplace for those.

And I'm kind of wondering if we're learning about the ownership patterns. You know, you can get a used Leaf for 10 to 15 thousand dollars, that's still in pretty good shape and, you know, doesn't have a lot of miles on it, maybe 30,000 miles on it.

So, is that important in some way for understanding how adoption's going to look? You know, that's one car with its particular niche, you know, in general. But I guess, you know, are we understanding this marketplace in some depth?

MS. BAHREINIAN: We also have -- in our model, we have prices of new vehicles, of course, but also prices in used vehicles. So, all of those influence consumer demand.

In addition to all of that we also, when it comes to policy, as we discussed before, incentives play a major role in our demand as well. And we have four different kinds of incentive that plays into it, including HOV, lane access, and the rebates, tax credits, free parking, all of these are incorporated into our model and we do account for those, too.

COMMISSIONER MC ALLISTER: Great, thanks very much.

Do we have any other public comment?

MS. RAITT: We do have one person on WebEx, if we've taken everyone from the room.

So, Eric Seilo, we'll go ahead and open your line.

MR. SEILO: Hi, how's it going? Yeah, this is Eric Seilo from SoCal Edison.

So, like several of the other comments that have been made, SCE additionally recommends that in addition to the forecast of using the sophisticated choice models that the CEC has been developing that we also employ different scenarios that incorporate existing and

planned governmental regulations. That not only are limited to the ARB goals, but also incorporate Federal, State and local incentives and requirements.

And then, additionally, we recommend using or having a high case scenario that assumes achievement of Governor Brown's long-term state and climate goals and, you know, the Federal air quality requirements under a variety of different fuel and technology mixes.

And so, I think that a simpler approaching using scenarios gives us a lot more flexibility and insight on what regulations may do and how they can be incorporated in the outcomes of those impacts on the transportation sector.

COMMISSIONER MC ALLISTER: Thank you for calling in.

MS. RAITT: Okay, so I think that's everybody on WebEx. We'll go ahead and open the phone lines, and if you want to make a comment, please unmute your phone. And if you don't want to make a comment, please mute your phone.

It sounds like we're done with public comments.

COMMISSIONER MC ALLISTER: Okay, great.

All right. Well, I want to thank the presenters. A lot of great information today and I think it really gives us a sense of how far along we are

and how much staff is thinking about this. And I really appreciate all the work. And, obviously, you know, highlight again the word "preliminary". And I think that really shows us that there's a lot of additional interaction and, you know, truing up and taking new data as it comes in to improve, and make sure we're triangulated with all of the folks both within the building, and across the marketplace, and certainly with our agency colleagues at ARB and PUC.

So, really, with that I'll just say thanks again to everybody for being here and looking forward to the next iteration. And I'll pass the mic to Commissioner Scott.

COMMISSIONER SCOTT: Yeah, I would just -- I think we're channeling each other today. I was going to also make the kind of emphasis on the "preliminary". Thank Gordon, for his terrific summary. That kind of added the big picture, the broader picture for how all of this fits together.

And just kind of step back and note, to me, it continues to be impressive that we have this kind of data gathering and analysis expertise right here in house. And so, I really appreciate the good work that you all do.

And I wanted to thank you, also, for the

engaging presentations because this material is fairly complex, and it's pretty darn wonky. And you did a good job, I think, making the presentations engaging. So, I appreciate that.

And thanks to our commenters and everyone who came to participate in the workshop today, as well.

CHAIR WEISENMILLER: Again, I'd like to thank everyone. This is an important topic. Certainly appreciate the staff's hard work in this area. And, basically, appreciate people's comments on how we can do better. Thanks.

COMMISSIONER MC ALLISTER: Great. All right, I think we're adjourned. Thanks, Heather.

(Thereupon, the Workshop was adjourned at 12:12 p.m.)

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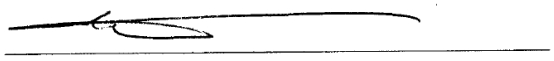

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