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BEFORE THE

CALIFORNIA ENERGY COMMISSION

In the Matter of:	)	Docket No. 15-IEPR-10
	)	
2015 Integrated Energy	)	NOTICE OF WORKSHOP RE:
Policy Report (2015 IEPR)	)	Inputs and Assumptions
	)	for Transportation
	)	Energy Demand
	)	Forecasts

CALIFORNIA ENERGY COMMISSION
1516 NINTH STREET
ART ROSENFELD HEARING ROOM, HEARING ROOM A
SACRAMENTO, CALIFORNIA

THURSDAY, MARCH 19, 2015
10:00 A.M.

Reported by:
Rebecca Hudson

A P P E A R A N C E S

Committee Members Present

Andrew McAllister
Lead Commissioner for IEPR

Janea Scott
Transportation Unit

Staff Present

Aniss Bahreinian, Ph.D.
Forecasting Unit

Jesse Gage

Bob McBride

Heather Raitt
Assistant Executive Director

Ivin Rhyne, Office Manager, Natural Gas, Procurement Analysis, Distributed Generation Integration, Transportation Fuels Data

Gordon Schremp, Energy Assessments Division

Gene Strecker
Forecasting Unit

Ysbrand van der Werf

Also Present

Amber Blixt
Independent Energy Producers Association (IEP)

Tom Carlson
Sierra Research

Jeremy Herbert
California Air Resources Board (ARB)

Marc Melaina
National Renewable Energy Laboratory (NREL)

Dillon Miner
Caltrans

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P R O C E E D I N G S

MARCH 19, 2015 10:04 a.m.

MS. RAITT: All Right. Good morning. Welcome to today's IEPR Workshop -- Joint IEPR Workshop for Transportation and IEPR - the Inputs and Assumptions for Transportation Energy Demand Forecasts. And I'm Heather Raitt, the Program Manager for IEPR.

I'll begin by going over the usual housekeeping items. Restrooms are in the atrium. If there is an emergency and we need to evacuate the building, please follow staff to Roosevelt Park, which is diagonally across the street from the building.

Our workshop today is being broadcast through our WebEx conferencing system and parties should be aware that 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.

Today, we'll have presentations by Energy Commission staff and consultants and an opportunity for public comments at the end of the day. We're asking parties to limit their comments to three minutes during the public

comment period. We'll take comments first from those in the room, followed by WebEx participants and then phone-in-only participants.

For those in the room who'd like to make comments, please fill out a blue card and give it to me and, when it's your turn to speak, come to the center podium and speak into the microphone. It's also helpful to give our 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 comments or open your line at the appropriate time.

For phone-in participants, we'll open your lines after we've taken other comments.

If you haven't already, please sign in at the entrance of the hearing room where the materials are available for this workshop. Written comments are due today -- on today's topics on April 2nd and the notice to the workshop explains the process for filing comments.

And, with that, I'll turn it over to

Commissioner McAllister.

COMMISSIONER McALLISTER: Thank you, Heather. I'm Andrew McAllister, the Lead IEPR Commission this year and Janea Scott, the Lead Commissioner on Transportation. This is a joint workshop for -- with -- of -- in which we are both extremely interested.

And I want to thank you all for coming, both those of you in the room and on the WebEx or on the phone. We -- as the notice says, we -- this is a critical part of our energy demand forecasting process. Transportation obviously is extremely important. After all, we are Californians and we, historically, have really liked our cars, obviously.

But, we also are an economy built on innovation and there is, I think, more interest in the transportation section these days than there's really, in -- in my recollection, there's ever been, partly because there is just incredible technology development going on just every day - improvements in the technology of -- with -- across the transportation sectors.

And also, obviously, this year we have, I think, a heightened sense of the goals that we

are setting going forward for improvement in the transportation sector in terms of greenhouse gas emissions.

The governor's goal of halving petroleum use in our cars and trucks has been really put this top-of-mind for a much broader range of constituencies than it has been before in the past.

And so, there's challenge and opportunity. That's often the theme is that, where there are challenges, there's also a huge opportunity and I think we absolutely see that in our transportation sectors. It's very exciting what's going on, I think, in electrification, in improved combustion, in just a wide variety of technologies that we'll hear about today.

So, I know our transportation staff works hard and very capably on these issues. And thirty-eight percent of our greenhouse gas emissions, roughly, correspond to the transportation sector.

So, this is a huge area that we are setting aggressive goals on and then I think we're creating the groundwork to actually achieve those goals over time in concert with our

other -- with our sister agencies - PUC, ARB - critically there.

And this is an obviously -- a really critical part of our economy, as well. Goods movement and personal freedom, et cetera, et cetera are all parts of our identity as Californians. So, this is really key work for laying the -- laying the groundwork for our policies going forward and I'm real excited to hear what everybody has to say.

So, I'll pass it to Commissioner Scott for some comments on her part.

COMMISSIONER SCOTT: Sounds good. Thank you, Commissioner McAllister. And I think you and I are a lot on the same brainwave this morning. I had very -- very similar thoughts.

Good morning and welcome to all. I'm Janea Scott. I'm a Lead Commissioner on transportation and I am very interested in learning more about how the transportation energy demand forecast will be carried out, and in learning about the inputs and assumptions used in the varying forecasting models.

I'm especially interested in understanding how the forecasts will incorporate

and model the state's key transportation goals and policies, like the 1.5 million zero-emission vehicles on the road by 2025 or the LCFS or Governor Brown's, as you mentioned, stated the state goal of an up to fifty percent petroleum reduction by 2030.

So, I think all of the topics that are listed in the notice for today's workshop are incredibly relevant and incredibly timely. As you all know, and Commissioner McAllister said this but I'll repeat it because it's important, is the transportation sector is currently responsible for about forty percent of the greenhouse gas emissions in our state, about eighty percent of the smog-forming oxides of nitrogen or NOx in the state, and about ninety-five percent of the diesel particulate matter emissions.

So, reducing pollution from the transportation sector is going to play a critical role in achieving our climate, our clean air, and our petroleum-reduction goals. And so, I also am very much looking forward to the presentations today and also to hearing the thoughts and comments from our stakeholders about how the

Energy Commission can best prepare our transportation demand forecast.

So, that you very much.

COMMISSIONER McALLISTER: All right. Thank you.

So, I will pass it to Ivin Rhyne, who's going to lead us off.

MR. RHYNE: Thank you, Commissioners.

Good morning. My name is Ivin Rhyne and I am the overall project manager for the sort of interconnected work that's going on here at the Energy Commission to connect the forecasts that are taking place as a part of the 2015 IEPR in a way that allows them to talk to each other and work together in ways that are comprehensible and understandable, but, more importantly, that reflect the ongoing reality that California's energy sectors today are more in -- interdependent than they were perhaps twenty years ago, and technology is -- Commissioner McAllister mentioned, is driving that interconnection even further.

So, as part of the 2015 IEPR, the transportation demand forecast, the electricity -- the -- sorry -- California's

electricity demand forecast, the natural gas outlook, as well as the work that we are doing to model the electricity dispatch are all being done in a coordinated fashion.

In doing so, we -- we worked very hard to align the input assumptions, align, in reality, the -- the world that underlies each of these models. And, in doing so, we've created and are creating what we are calling the IEPR common cases. Those IEPR common cases are essentially named around the demand profile.

So, it's a high-demand world, a low-demand world, and a -- a central or reference case that allows us to, as you look at the demand forecast, as it will -- as it will occur and be published later, you'll be able to at least understand how that -- the high-demand forecast, high IEPR common case in that forecast connects to the high-demand forecast that comes out of the electricity demand and -- as well as in the natural gas sector.

That interdependence is critical. Now, if you're like me and you think that the forecasting part of this -- of this whole process is the -- most fun --

(Laughter.)

MR. RHYNE: -- it's -- it's fun because we're -- we're able to connect those policy goals that Commissioner Scott mentioned to envision what the future might look like as we move forward. And so, I -- I'm going to pause for a moment.

There was a lot of work that went last year into the 2014 IEPR Update. That IEPR Update includes a number of transportation-related policies, goals, a -- a lot of discussion and work and thought that went into that.

There is actually copies of the 2014 IEPR Update out at the front table as you come in. So, I would encourage you, if you're interested in that. If you haven't already picked it up, you can pick it up in paper form or there are CDs there.

Beyond just --

COMMISSIONER SCOTT: I second that.

(Laughter.)

MR.: Say again?

COMMISSIONER SCOTT: I said I second that.

(Laughter.)

MR. RHYNE: So, you -- we're able to connect those policies into envisioning what the future world might look like. In doing so, we have to use models.

So, these models are necessarily simplifications of the world, but they allow us to draw insights as to how we might get to that future state, where we might need additional action, where we might be able to make improvements on what we are doing, and, at the end of the day, help us make -- help inform our decisions, both today, tomorrow, and in the future.

This is an ongoing work that we will do and in -- in the midst of all of that, we are considering other scenarios beyond just the IEPR common cases and you'll hear about some of that today.

And we are working hard to make sure that we reflect the input of -- of the stakeholders who are in this room and online.

So, I want to encourage everyone, as we're about to -- to launch into these presentations, to really give these slide decks, give these presenters your thought, your

attention, and, where you have comments, to please use our commenting process in the IEPR.

It's automated now. It's online. You can submit those comments online and there'll be -- there's a place in the notice for that information and there will be a slide at the end so you can -- help you find it.

But we really rely on stakeholder feedback. The -- your expertise, your viewpoints, and your input to improve the product that we do.

So, with that, I'm going to turn the podium over. We'll have each of our presenters come up and I'll ask them to sort of introduce the -- the folks behind them. But first, we have Gene Strecker, the Supervisor for our Transportation Demand Forecast group.

MS. STRECKER: Good morning. Can you all hear me?

I'm Gene Strecker. I'm the Supervisor of the Transportation Energy Demand Forecasting Unit. We're a very small group of people. We've taken on a huge challenge of forecasting a number of fuels, technologies.

And I would probably -- before we get

started, I should apologize in advance. I've had a pretty bad cold or flu for the past week or so and I expect I'll be coughing halfway through my presentation. I'll try not to but who knows what's going to happen?

So, we're going to get started off this morning by talking about California's vehicle fleet. We -- for -- for about twenty-five years, we've been getting Cal -- or DMV's vehicle registration database twice a year. We get a snapshot of their database in October and in April.

We use -- we use that database because what we're really looking for to populate our models are on-road registered vehicles - the number of vehicles in different categories - and we'll look through some of those this morning. Why do we want on-road registered vehicles? Because they're the ones that use fuel.

There's about fifty million records in DMV's database and, of those fifty million, approximately twenty-eight, twenty-nine million are appropriate to us. There's lot of things in the DMV's database that we are not interested in, such as trailers or people who register their

vehicles as non-operational.

So, we have to weed through those fifty million records and pull out the ones that are most appropriate for us. And we'll have people later on talk about -- more about how we use -- use those vehicle counts, but here's just a -- a high-level look at what we do.

So, we split the vehicles up into light-duty vehicles and medium- and heavy-duty vehicles. To us, a light-duty vehicle is a vehicle that's ten thousand pounds or less. I know other agencies and entities define light-duty and medium/heavies a little bit differently than we do but, for our purposes, light-duties are ten thousand pounds or less and medium and heavy are ten thousand pounds and greater.

We use our light-duty vehicles -- we split them out into personally-owned vehicles and essentially vehicles that are owned by commercial entities, and they feed our Personal Vehicle Choice and Commercial Vehicle Choice models. And our medium- and heavy-duty vehicles are essentially fed into our Freight model. It's a little more complicated than that, but this should suffice for the time being.

We also break out ownership categories of government vehicles and rental vehicles and we do some post-processing on those, as well. They're not fed directly into our models, though.

So, this is just an example of the total vehicle fleet that we've been seeing in California. You can see from this slide that the light-duty vehicles far outnumber the medium and heavies by quite a bit, and the populations of these vehicles are both growing at this time.

And, as you might expect, Los Angeles region - the four or five counties, including Los Angeles and the ones around it, have, by far, the greatest number of vehicles in the state. That shouldn't surprise anybody.

So now, this is where it starts to get interesting. This is the distribution of fuels in our light-duty fleet. As you can see by this graph, gasoline far outweighs anything else in the fleet by quite a bit - a huge amount.

And now, I'm just going to shift gears just a little bit to look at -- see how the ownership categories are -- look throughout the state. You can see, through this slide, don't be misled by these bars. If you look carefully at

this slide, you'll see that we start at seventy-five percent.

So, if you -- if you look carefully, you'll see that personal vehicles in 2013 represent about eighty-five percent of California's fleet, followed by commercial vehicles, which are another twelve or thirteen percent, and then rental and government are a very tiny percentage of California's fleet.

And I think my slides are out of order. No, maybe not. Okay.

And here we show just the different vehicle classes. You know, we all -- we -- these are important to us for a number of reasons, but you can see -- and we're just showing personal and commercial here because the percentage of government and rental are just so tiny they would never even show up on this chart.

But the distribution of vehicle types are fairly well distributed throughout the vehicle classes. So, we go from subcompact cars, which are the really little, tiny things, all the way up to pickup trucks. And we do show a little bit of neighborhood electric cars in there just for comparison purposes.

And you'll see they're fairly well distributed throughout the vehicle classes. And the one thing to take away is you'll notice that most of the -- most of the vehicles are subcompact, compact, and midsize, and that due to fuel economy, mostly.

The takeaway from this slide is that the number of alternative fuels and technologies in the fleet -- in the light-duty fleet is growing pretty well.

Now, this is another slide to look at carefully because we start at eighty percent. So, you'll see that gasoline vehicles far outweigh anything else in the fleet.

Diesel vehicles are holding fairly steady through the past five years - about 1.7, 1.8 percent of the fleet, and the alternative fuels and technologies are definitely growing. In 2009, they started out about three percent of the fleet, and now they're up to about six percent of the fleet.

COMMISSIONER McALLISTER: Gene, could I -- could I ask a -- a clarifying question?

MS. STRECKER: Sure.

COMMISSIONER McALLISTER: Could you go

back just a couple slides?

MS. STRECKER: Certainly.

COMMISSIONER McALLISTER: To the -- to the -- that one.

MS. STRECKER: Mm-hmm.

COMMISSIONER McALLISTER: So, that seems like a big change, particularly from 2009 to 2010, but -- and now you -- I understand it's all within that five percent -- you know, four percent band or so between eighty and eighty-five percent, but --

MS. STRECKER: Right

COMMISSIONER McALLISTER: I would have thought that -- that -- you know, expect it to vary a little bit with the economy and stuff, but also thought the -- the distribution of commercial and -- and personal would be roughly, you know, sort of already at the tangent, because we're been driving cars for a long time.

And I'm wondering if you have a sort of feeling about or thoughts about why personal is growing as a portion of the total.

MS. STRECKER: I think I would have to ask one of our economists to explain that, if they could. We -- we have a little bit of a

dilemma in that the person who's been looking at the DMV data for us left the office in November --

(Laughter.)

MS. STRECKER: -- and we just recently hired a new person, and it would be really unfair to ask her to try to explain that --

COMMISSIONER McALLISTER: No, no worries --

MS. STRECKER: -- at this point

COMMISSIONER McALLISTER: I guess -- I guess, just food for thought. I mean, I'm assuming it's because the economy --you know --

MS. STRECKER: It could be pent-up demand or something like that from consumers. You know, under the Great Recession, they weren't buying anything --

COMMISSIONER McALLISTER: Yeah.

MS. STRECKER: So, we could see more of a pent-up demand being --

COMMISSIONER McALLISTER: Anyway, that's part --

MS. STRECKER: We'll look --

COMMISSIONER McALLISTER: -- of the -- part --

MS. STRECKER: We'll --

COMMISSIONER McALLISTER: -- of the econ demo discussion.

MS. STRECKER: Yeah.

COMMISSIONER McALLISTER: But, yeah, thanks.

MS. STRECKER: We'll certainly look into that and get an answer back to you.

COMMISSIONER McALLISTER: Thanks very much.

MS. STRECKER: Okay. So, I'm just going to slip on back to this slide because I wanted to talk about the growth in the alternative fuel and technology portion of the fleet.

You-- you'll see from this graph that it -- it looks like it's pretty much doubled from between 2009 and 2013. I want to point out, though, that the large percentage of that is due to FFVs, the flex-fuel vehicles that are gasoline and can be powered by gasoline of E85 and gasoline hybrids.

And, if you flip back to this chart and look at the percentages along the side, and -- you can see that quite clearly from that chart.

Now, flipping back. And I'm just going

to take probably thirty seconds to talk about the medium- and heavy-duty fleet. We're going to have a rather lengthy discussion about medium- and heavy-duty fleet later this afternoon by Bob McBride.

So, I just wanted to point out that the distribution of fuels in the -- in the medium/heavy fleet is a little bit different -- well, a lot different than light-duty. Most of the medium/heavy, obviously, are fueled by diesel and then gasoline.

And we see smaller percentages of growth in the alternatives. And this -- this shows the growth in those alternative fuels. And it's actually -- in 2009, they were about two percent of the fleet. In 2013, they were about three percent of the fleet.

And this is another one of those graphs to look at carefully because, if you notice, the -- the y-axis starts at forty percent, not zero.

And so, that's all I really wanted to talk about for the vehicles. You'll hear more discussions of vehicles, both light-duty and medium/heavies later in the day.

And does anyone have any questions?

(No response.)

Is there anyone online? No questions?

(No response.)

Okay. Well, if you think of anything, please let us know. We're happy to take your input, feedback, get your comments. And, if there's nothing else for me, I'm going to introduce Aniss Bahreinian. She's one of the unit's staff members, and she's going to be discussing an overview of our demand models.

MS. BAHREINIAN: Good morning. My name is Aniss Bahreinian and I work in the Transportation Energy Forecasting Unit. And today I am here to give you an overview of the Transportation and Energy Demand models that we use in our unit.

We are going to talk about how our models forecast transportation energy demand. We'll talk about some of the relationships among the models. We'll talk about the inputs to these models and the sources and how they flow through the models. And we'll talk about the sources of projected input demand, as well as the sources of data for the base year.

And, of course, we are here to seek your input on a number of questions and a number of topics that you are going to find out later.

Our job at the Transportation Energy Demand Forecasting Unit is to forecast transportation energy demand, needless to say. However, nobody really wants gasoline just for the sake of having gasoline.

Gasoline is going to move your car and your car -- you really don't want your car, either. You want your car for doing something for you - for getting something done for you. And in economics we call these things as derived demand.

Your demand for a car is derived from your demand for transportation. And your demand for fuel is derived from both of those. So, you can see that, in the middle, we have the transportation and energy consumption, but that is a product of the number of miles that you travel, the number of vehicles that you own, and the fuel economy of these vehicles that you own.

We should also say that, as you can see here, on the circle on the right-hand corner, we have put "on-road energy intensity per mile," and

that's important because the type of driver that you are is going to determine the energy intensity of your car.

If you're an aggressive driver, you're going to use more fuel; your car is going to use your fuel. If you are driving to Tahoe, you're going to more likely use more fuel compared to when you're driving on the flat roads in Sacramento.

So, when you drive matters. How you drive matters. How many cars you drive matters. And how long you travel is going to matter. All of these are going to determine your transportation and energy consumption.

The number of miles that you travel, of course, is a function of the economy. As the economy grows, as people are gaining employment, then they are going to buy more cars to begin with and then they are going to drive more because you have to go to your work and a lot of the people are using their cars to get to their work.

So, with the improvement in the economy, there's going to be an increase in VMT. An increase in VMT is going to, then, result in an

increase in transportation energy consumption and an increase in vehicle stock.

So, in order to address all of these -- so, we have miles traveled per vehicle that is begging for a Travel Demand model. And then, we have the vehicle stock and that is begging for a Vehicle Demand model.

So, here we have two types of demand models in order to derive your demand for transportation energy. One is the Vehicle Demand model; the other one is a Travel Demand model.

Our Vehicle Demand models are mostly focused on light-duty vehicles. The two models that we do have in our family of models are the Light-Duty Vehicle Demand models and they give us a stock of vehicles.

Now, we have one demand model for household and then we have another demand model for commercial sector. Why do we have two demand models? Because a lot of different studies that see, they only have one Light-Duty Vehicle Demand model. But we have two.

Why do we have two? Because we have two different sectors that behave differently, they have different preferences, they have different

needs, and they need a different stock of vehicles.

So, for these reasons, we have two different demand models. If you go back to -- which one? Okay, this one. All right. Sorry, I had numbers and it was decided that we shouldn't use the same numbers in different presentations. So, I have to go back to the previous presentation.

If you look at this slide here, this is kind of telling you why we need two different behavioral demand models. Look at the distribution of the vehicles by class. Look at the ones at the end.

You see that purple bar at the end? You don't see -- you hardly see anything green. What this is telling you is that the commercial sector uses most or all of the vehicles in the 8,500 to 10,000 category.

This important because these vehicles usually have lower fuel economy, which means that, even if they have fewer of these in the commercial sector, they will -- they could be using a larger amount of fuel because the fuel economy of these vehicles is lower than, for

instance, the subcompact vehicles.

If you look at the distribution, again, in the beginning for the subcompact and compact and midsize, you see that kind of both commercial and personal are moving along in the same way. If you look at the relationship, it's almost staying the same.

And what it shows is really the largest number of cars sold are those midsize vehicles. So, the midsize vehicle is a pretty popular car, both for the commercial and for the household sector. But, in the end, the last bar shows that 8,500 to 10,000 pickups are the vehicle of choice for many of those in commercial sector.

If you also look at the bar in -- somewhere in the middle - sports -- sports utility vehicles. That is, again, 8,500 to 10,000 pounds.

And another one, for van - 8,500 to 10,000. And the van standard, you see -- you could hardly see any green bars here. That means that all of these cars are used the commercial sector - almost all of these cars are used by the commercial sector.

Everything else is kind of equally

distributed, but, in these categories, you can clearly see the differences between the two sectors, and these differences are the reason why we conduct two surveys - one for commercial and one for residential sector. And that is why we have two models - because they behave differently, they have a different number of vehicles, and they use a different amount of fuel.

I should also say something else that is not in these slides -- is that -- is the age distribution. Another difference between the commercial and the residential is the age distribution.

The majority of the commercial sector - they own a larger percent of newer vehicles versus the household sector that has a lot more of the purchases of the used vehicles.

This is important, particularly when it comes to alternative- and renewable-fuel vehicles because these vehicles are usually available in the newer categories and, therefore, those who are more likely to buy new vehicles are the ones who are going to be more likely to purchase these alternative-fuel vehicles. So, that is another

distinction between the commercial and residential sector.

Can you move that? Actually, there was another slide in Gene Strecker's slide deck that was showing the distribution of vehicles between rental, government, and commercial, and residential. I should go back to that later.

So, these are the two types of demand models - the Vehicle Demand model -- and, as you could see in that slide, they have fifteen vehicle classes in eleven different fuel/technology types. And that is very important. That is actually more extended than many other models around.

Our Travel Demand models cover both short distance and long distance and they cover both goods movement and peoples movement, as well as the services. We have the Urban and Intercity model. "Urban" is short for Short-Distance Travel model; "intercity" covers the Long-Distance Travel Demand model.

And, as you can see, later on when Jesse Gage is going to talk about the high-speed rail, we are using that high-speed rail in conjunction with the Intercity model because intercity covers

the long-distance travel.

The Freight model, which is going to be composed entirely of the heavy- and -- medium- and heavy-duty vehicles, it is used in both goods movement and service activity.

For goods movement in the long-distance, we allow the freight to compete two modes against each other - that is rail and trucks, but, when it comes to short distance, rail does not compete with freight.

And, actually, one of the differences between our Freight model and some of the other freight models is that we do cover service activity in our Freight model. Service activities like, for instance, concrete mixers, refuse trucks, and activities like that.

The other model that we have is the Aviation model. And our Aviation model is actually segmenting the market in a number of different ways. It segments the market into business travel and personal travel. It segments the market into intrastate, interstate, as well as international market.

And a lot of people are unaware that a very significant of the jet fuel used in

California is for international travel. So, we managed to segment all of these different sectors and, therefore, we are forecasting fuel -- jet fuel for all of these different segments separately.

However, I should say that this time around, we are not using the model that we used time or the last two times for a number of reasons. And this time, our colleague, Gordon Schremp, is going to use one of our older models to address this.

When it comes to commercial light-duty vehicle miles, we take care of that in the Commercial Light-Duty Vehicle model. And that model, within it, has a VMT component that is going to measure the number of miles -- or forecast the number of miles for this sector.

So, notice that, when we -- a lot of people, when they're talking about commercial movement, they combine the light-duty vehicle and heavy-duty vehicle - we separate the two from each other.

And then we have high-speed rail, which is a post-process model. We used that for the first time in 2013 in response to Commissioner

Weisenmiller in the first workshop that we had. He recommended that we use that and then, by the end, we actually used the high-speed post-processing date and included it in our final forecast -- or revised forecast.

So, what are the different travel modes and vehicles in the Travel Demand models? If you look at the columns, we have the vehicles, Light Rail, bus, conventional rail, high-speed rail, and air.

These are different types of vehicles that we are using. The travel -- the Travel models are urban - again, short distance; commercial LDV travel - so, that another measure of commercial movement. That is your pizza delivery guy, for instance.

The Intercity model that measures long-distance travel; aviation; air freight; freight for goods movement; freight for service movements; and high-speed rail is used for long-distance.

In the Urban model, we use light-duty vehicles, but we also, of course, have bus, Light Rail, and conventional rail, which is used for commuters.

In the -- in the Commercial Light-Duty Vehicle Travel model, which is a VMT component, we only use light-duty vehicles. So, we don't use transit, for instance, for commercial LDV travel. Transit is only used -- urban transit is only used for personal travel, not for commercial LDV travel.

In the Intercity, Long Distance model, we use light-duty vehicles, but we also use bus - but is one of the modes. Auto is one mode, which is the LDV. Bus is one mode. Conventional rail is one mode, and high-speed rail is, of course, what we post-process.

In addition to that, we also have air travel in the Intercity model. In the Aviation model, which was self -- standing by itself, that's when we only have air mode, obviously.

In the air freight, again, another stand-alone component - uses only air. In the freight for goods movement for long distance, we compete both in rail and trucks. So, those two modes are used in goods movement. For freight service, we only use trucks - medium- and heavy-duty trucks. HSR, of course, is the high-speed rail.

Next. All right. So, here we are -

these are all of our models that we have discussed. If you -- if you look at the blue bar at the top, it includes all of the different inputs that we are obtaining from different places.

The used EIA crude oil price forecast - and that is one of the sources that we use - we use economic, demographic, and other data from other colleagues at the Demand Analysis Office. We use our DMV stock, which is analyzed within our own Transportation and Energy Forecasting Unit.

And then, we use all of these to get different inputs that we need for different models. You can see that the red rectangle in the middle, which is quite red, it shows actually the heart of our model. That is our transportation energy price forecast.

That input is used in every single model that we have -- almost every single model that we have.

The oval -- light green oval shapes that you see - these are different behavioral models that we have within DynaSim -- within -- I said it too soon. I'm going to go to the next slide

and talk about DynaSim, but these are our behavioral models.

The behavior models are Personal Vehicle Choice - this is a nested, multinomial logic model. We have Commercial Vehicle Choice, which is a multinomial logic model. We have Intercity Travel, Urban Travel, Aviation, and Freight.

When it comes to primary data that we have -- we have our own primary source of data. The primary source of data that we use are the two surveys that we conduct for commercial and household vehicle surveys. These are the surveys that are conducted from -- starting from 2011, ending with 2013, and we are going to talk about them later, more.

Another very important input that we use here are the light-duty vehicle attributes. That is a very important component of our forecast, and Sierra Research is going to make a presentation on that later this morning.

Our Personal Vehicle Choice model, as we said before, both produces the vehicle stock or vehicle population, as some would call it, as well as the VMT in the commercial sector -- commercial light-duty vehicle sector.

Personal Vehicle Choice model is generating vehicle stock for the household sector. We take that vehicle stock and then we share that with the Intercity and Urban models. That is why you see those blue arrows.

So, the first personal vehicle stock is generated within that model, what we call PVC, and then it is shared with the other two models, Intercity Travel and Urban Travel. It is combined with the travel outcomes of those models, and then fuel consumption is generated within Urban and Intercity models. Likewise, Commercial Vehicle Choice model that has both the vehicle stock and VMT component directly feeds into fuel consumption.

Freight model is -- a Freight model and Aviation - both of them also generate fuel consumption within them. So, all this fuel consumption, then, is add -- added together and they create what we call as California on-road transportation and energy demand.

I want to caution you here because some people call rail as off-road. For our purpose, we call it on-road energy. That's part of our behavioral models forecast and we include that

all in this category.

So, our Transportation Energy Demand Forecasting models are sector specific. As we just mentioned, we have Freight, we have Urban Travel, we have Intercity Travel, Aviation, we have Commercial Light-Duty, Residential Light-Duty, et cetera.

These are all sector-specific demand models. Each one of them are representing consumption behavior of that sector. So, we don't lump all of the energy together and use trend projections in order to project fuel consumption.

We look at every single sector and we decide, okay, how does prices affect travel demand for freight movement? How do -- how the fuel prices are going to affect travel demand by the household sector how the fuel prices are going to affect travel demand by commercial light-duty vehicle sector. So, we have sector-specific demand models.

COMMISSIONER McALLISTER: Aniss, can you talk about how geographically specific --

MS. BAHREINIAN: Uh-huh.

COMMISSIONER McALLISTER: -- your

analysis is? I'm -- I'm wondering, you know, one place might have roundtrip -- typical roundtrips longer than another, so that might affect, you know, how EV uptake evolves and things like that. I guess I'm wondering sort of how granular your --

MS. BAHREINIAN: Absolutely.

COMMISSIONER McALLISTER: -- method is.

MS. BAHREINIAN: One of the things that we -- we do -- I mean, I'm very glad that you asked this question. We have a Statewide Travel Demand model. My colleague, Bob McBride, later in the morning is -- later in the day is going to talk about the VMT and how there are any differences.

But, for the most part, what we have is a statewide travel. We did have a model at the county level before, but there were some issues with the data and we had, in order to preserve more accuracy, you had to go back to the statewide. That's what happened.

COMMISSIONER McALLISTER: Do you -- I remember in the -- in -- two years ago, when we had this discussion, we talked about some of the possibilities, maybe challenges, of working with

the COGs or the MPOs, because they're running, you know, transportation planning models that do get into those granular details.

Obviously, a lot of heterogeneity across the state, but that might be a place to try to bootstrap some -- some more geographically-specific, you know, analysis. If not now, then sort of think about how that would go in the future.

MS. BAHREINIAN: Absolutely. And one of the things we were doing this time around because, as I'm sure you have read in some of the PSRs, et cetera, we work extensively actually with Caltrans. And Caltrans has a model that they call the California Statewide Travel Demand model.

And the California Statewide Travel Demand model also incorporates those MPOs and COGs into that. And so, we do make the attempt to bootstrap some of those, but our only internal models are statewide models at the present time. In the future, we can improve them, of course.

So, these are all economic models, and the question is, okay, what does that mean when we say economic model? Because what they do -

they measure the responsiveness of the consumers to some kind of economic variable, whether it is cost of travel, time of travel, cost of a vehicle, or what have you, and they account for changes in the economy.

If incomes go up, our demand for travel is going to go up. That's an economic behavior. And so, for all these reasons, we call them economic model - the accounting for the impact of time and cost of an activity or a product, as well as income and economic output, in the choice process.

And, I should also add that some of those models are choice models, some of them are not. We call all of those models econometric models. That would be a more accurate description if you are going to use one word to describe all of them, because we have used econometric -- or, econometrics has been used to derive those models.

All of these are functioning in a software platform called DynaSim. And we should also note that all of our fuel consumption is only going to account for the tank-to-wheel energy consumption. We do not include anything

before or after, not that we don't want to, but our models are like that. (Laughter.)

So, a demand model is generated within each model - that's another characteristic that is quite important, actually - based on travel mode and vehicle choices of the consumers. When consumers select one type of vehicle, they forego another.

So, we can't really increase all of the vehicles at the same time, unless there is a huge population growth that is going to demand something like that. So, if I buy an EV, that means I'm buying an FCV. That means I'm not buying a gasoline vehicle.

If the prices of gasoline go down, then I'm going to buy - and as actually it has been the case in 2014 - there has been increase in demand for SUVs because gasoline prices have gone down.

If you're buying an SUV, that means you are not buying a compact car. So, there is all this substitution and competition between vehicle classes, between fuels, and between technologies.

We cannot really simply use the stock of an additional vehicle or fuel or a technology

type, or increase the stock of another without affecting the stock of other vehicles in the model or other travels -- travel modes in the model.

If people are -- if people are using more transit, that means they are not using their cars. And so, all of these are important and all of these substitutions take place within the models.

Now, those are the models that we have in the software platform we call DynaSim. So, all of those -- let me go back to that. All of these models that you see here -- all of them reside within DynaSim.

What is DynaSim? DynaSim basically houses all of these different types of models. As we said, some of them are aggregate, some of them are disaggregate models, some of them are choice, some of them are not. These are all the different models, and all of them reside within this software.

That means that every time -- the model structure is hard-coded into the software. So, every time you make a change to the structure of the model, every time we add a variable, every

time you want to change the interface with the model, we are going to have to update the software. That's what it means.

Now, DynaSim, of course, was -- was envisioned by Commissioner Desmond back in 2005, and he wanted the staff to pursue that. In 2011, DynaSim software was actually implemented in the Transportation and Energy Forecasting Unit, and we have been working on improving it ever since.

So, every time, every month, every year, every quarter, we are making changes, we are making improvement because we want it to perform better.

One of the improvements that we have made since 2013 is adding what we call VMT decay rate because, in the past, we assigned the same number of VMT regardless of the age of the vehicle. We all know, however, that newer vehicles drive more and, therefore, now we have added that VMT decay rate.

Another -- another advancement that we have made to the -- or another change that we have made since 2013 is that we have added a time dimension for the consumer preferences, for fuel type, and vehicle class.

That's actually quite important because, in the past, the model did not allow us to change consumer preferences over time. We always had to assume that it was constant. Now, we don't. We can make changes if we want to.

We know consumer preferences change, but we don't know exactly how they are going to change. (Laughter.) That's the challenge and, if there's anybody in the audience among the stakeholders who does know, then we would really appreciate your input.

We just don't want it to be a -- an arbitrary decision, because keeping it constant is also arbitrary. But, we don't want to replace one arbitrary decision with another arbitrary decision. So, if there's any scientific study of how these consumer preferences change over time, we are seeking your input on that.

COMMISSIONER SCOTT: I'm going to -- I have a question for you --

MS. BAHREINIAN: Sure.

COMMISSIONER SCOTT: -- about -- so, if you're -- if we're constantly improving the model, which I think is a good thing, right, to make sure that we are -- we've got the -- the

best, most robust information we have, how can we compare sort of the -- the output from one year to the next year?

Are you able to kind of tease out what's the difference between the tweaks -- or maybe tweaks isn't the right word, but, you know, the -- the edits and updates that we made to the model from differences and --

MS. BAHREINIAN: Yes, we can.

COMMISSIONER SCOTT: -- the actual trends?

MS. BAHREINIAN: We can. For instance, with the VMT decay rate, if we want to make it comparable to say what we have done in the past, we can keep it constant. And then, it will allow us to compare before and after change.

Or, when it comes to consumer preferences, if we decide to change the consumer preferences over time, we can keep it constant and we can increase it and then we can compare what happens before and after.

So, for some of the things, it does allow you, but not for everything. These are the two -- some of the two -- I mean, the two important ones that I mentioned, but there are

other changes that we have made, too - other improvements that we have made.

So, the Transportation and Energy Demand Forecasting models - as we said, they are sector-specific, and we talked about that already. And we said -- we talked about -- I'm sorry, these are the slides that I have gone over before.

So, other models and analysis - what else do we do? All of those models that we talked about - those reside within DynaSim, but there are other sectors that are not within DynaSim. And so, we try to account for that.

What are those? One of them is neighborhood electric vehicles. These usually have a speed limit and they are not necessarily on-road vehicles and, therefore, we are going to account for that in a separate way.

We also have government vehicles. If you go back to that slide, which I don't want to torture you to go through that slide again, that Gene Strecker was showing. It was showing that large cars were actually in low demand, both in the commercial sector and in the residential sector.

But, if you look at the government share

of the large vehicles, you could see that there are a lot more large vehicles in the government sector. What is that? Those are the police cars, for instance, that have to be large. That's just one example of it. So, for some reason, we saw a lot of large cars in the government sector.

And then, when it comes to the rental vehicles, while we don't address that in any of the others, rentals cars are the same thing as other commercial sectors, because the pure purpose of rentals is for the sake of transportation. We can't really put them next to each other.

In the past, they have been combined with the commercial and generated one forecast but, since 2013, we decided to separate them out because they behave differently because they have different age distributions.

Even though it is really a small portion of the vehicles, but still it is worth looking at. A lot of the vehicles in this sector are -- usually they are retired at the age of four.

You really don't want to go and rent a ten-year-old vehicle and most of the vehicles in

this sector are newer vehicles. Once they reach the age of four or five, then they are sold on the market to the household sector, to the residential sector.

So, we separate all of these. But these are really just growth models. There's nothing fancy about it. They are not behavior, we just grow them. But we think that it is still worth separating them out - calling them all out - because they have different VMT.

You can imagine, a rental car is going to (laughter) have a larger share of the VMT compared to some of the other sectors and they use different types of vehicles and they have different vintage distribution. So, all of these are -- justify the fact that we are separating these sectors out.

When it comes to government, government has to follow a lot more of the current laws in the state, like they have to purchase more EVs, more FFVs, et cetera. And so, it is important to separate all of these out.

Another post-process model is the high-speed rail and, of course, the off-road. And, this time around, Aspen Environmental Group is

going to use ARB's and other studies to give us projections of -- of transportation electrification, which was covered in another presentation, and other factors.

Transportation energy demand and supply - so, what do we do with this? We take the off-road -- we take the on-road that we come up within -- in -- within DynaSim. We take the off-road transportation energy demand and we put it into one pile and we call it "total California transportation energy demand."

We then take out electricity demand and natural gas demand and pass it on to the Electricity and Natural Gas Unit. And then, we try to bring them closer to a liquid transportation fuel supply.

Our colleague, Gordon Schremp, does an analysis of the Board of Equalization sales of different fuels and then we try to bring these together -- closer together. Not that they are exactly equal, but we try to bring them closer together in the calibration process.

What are the key assumptions? Well, when it comes to the vehicles, we say that all of the current federal and state regulations are in

place for original equipment manufacturers, or OEMs, including the ZEV mandate.

How do we address that? Sierra Research is charged with implementing those vehicle prices that are more likely to achieve the ZEV mandate. OEMs -- we are also assuming that OEMs meet consumer demand.

What does that mean? That means that we don't care how many cars you want, you are going to get it. If you want a million cars, you are going to get it. If you want ten million cars, you are going to get it. They are going to meet your demand. There is no -- there is no limit on the supply of these vehicles to California buyers. Whatever you want, you get. That's our assumption.

Likewise, when it comes to fuels, the same kind of thing - all the currently federal and state regulations are in place for transportation fuel, and our colleague, Gordon Schremp, takes the forecasts that we have, looks at the RFS2 and other requirements, and then distributes those among different fuels, as required by law.

Transportation energy suppliers meet

consumer demand. What does that mean? It means, if you want gasoline, you got it. You want a billion barrels of oil, you have it. You want ten billion barrels (laughter) of oil, you have it. There is no limit on supply of fuels to California, whether it is electricity, natural gas, or liquid fuel.

Vehicle and liquid fuel prices are independent of California demand. What that means is -- is that no matter how much fuel demand goes up in California, in our model, it doesn't affect the prices, and that's important.

We also make the assumption that price scenarios cover the range of plausible outcomes over the forecast horizon. That's our assumption.

Those of you who have seen our 2013 price forecast or EIA's crude oil price forecast, you know that we were, all of us -- EIA, us, and everybody (laughter) else in business has been dead wrong.

The current prices in 2014 are far below what EIA projected in 2013 and even in their 2014 forecast. Nobody really could see it coming and so we were all wrong. But, for our purpose, we

make the assumption that these are going to cover the plausible outcomes.

Consumer preferences - light-duty vehicle technologies remain constant at 2013 levels. That's what we have done in the past. Again, we are seeking your input this time. Time and cost of travel - the preferences of consumers for those are also going to remain constant.

What are the model inputs? Well, for 2014-2026 projections, income and employment, as was discussed in previous workshops, come from Moody's and IHS Global Insight. Economic activity in the business sector is going to come from those same sources.

Transportation energy prices is going to come from EIA, natural gas prices are going to come as a result of the analysis of Rice University and the Energy Commission, and electricity rates have already been presented in prior workshops, and they, too, are coming from Energy Commission analysis.

Class-specific light-duty vehicles, heavy-duty vehicles, and aircrafts attributes are provided by Sierra -- Sierra Research. Population and households - they come from the

Department of Finance, Moody's, and HIS Global Insight.

I should also add that we use American Community Survey to feed our Residential Light-Duty Vehicle Demand model and that is happening in the base year. So, for the base year, we use the American Community Survey to populate the households in our light-duty vehicle demand for the residential sector.

Travel activities for goods movement and services - my colleague, Bob McBride, is going to cover that. Travel activity for people movement - again, he is going to cover that topic so, in the interest of time, I'm going to just move forward.

2013 Liquid fuel consumption - we use -- we use the Board of Equalization data analyzed by Gordon Schremp and Gary Yowell.

What will 2026 look like? Well, as we said, products are socially constructed. Consumers learn from each other, producers learn from each other. Technologies change, products change, and I think Commissioner McAllister put it best - the changes in technology are so wide and so in-depth that really it is hard to project

all of this.

Changes in prices, as we have seen in the last few months, are going to add only complications to the entire story. There are way too many changes. And so, what we'd like to do is to seek everyone's input into this topic.

We know that there is plenty of uncertainties and we know that preferences are going to change. We know that income distribution is going to change. There is a whole group of variables and factors that will be changing over time.

And so, we are going to have to make -- we are going to have to make some assumptions in order to run these models and we try to seek your input to make the best assumptions that we can.

Any questions?

(No response.)

MS. BAHREINIAN: Thank you. I was over time for five minutes, which is good for me, actually. I usually run more than that. Sorry.

COMMISSIONER McALLISTER: Congratulations.

(Laughter.)

COMMISSIONER McALLISTER: Thanks for

that, Aniss. It sounds great.

MS. BAHREINIAN: I rushed through the last four slides. (Laughter.)

Any questions?

(No response.)

MS. BAHREINIAN: All right. Gordon Schremp is now going to talk about the crude oil market and fuels.

MS. RAITT: And just a reminder that there will be an opportunity for questions from the public at the end of the day. Thanks.

MR. SCHREMP: Good morning. My name is Gordon Schremp. I'm the Senior Fuel Specialist in the Energy Assessments Division, formerly the Transportation Energy Office.

So, yes, Aniss was talking about prices and how they've changed rather dramatically. Everyone is quite aware of that. They actually changed twice. You got -- everyone got a really early Christmas present last year when -- when the oil prices collapsed. And then, there was a bit of a rebound, one might say, with our most recent price spike in California - the highest price spike since 2012 that occurred rather recently -- so, really to primarily refinery

problems.

So, why do we care to look at crude oil prices and why are they important? Primary driver to the price of fuel. It certainly is the base price of crude oil. However, that moves -- that's the strongest correlation to prices, and Ysbrand will be talking about that after my presentation.

So, we care about crude oil price movement and we care to understand why they are changing so quickly, either down or up, but, more recently, down.

So, the purpose of my slides and my part today is to cover these factors, to talk about what some of the impacts are specific to the United States of this rapid decline, and also talk about some additional factors we would want to pay attention to moving forward over the near- and mid-term that could have an impact on future near-term prices, both up and down.

So, crude oil prices -- so, you hear a lot in the popular press - you hear things of Brent, you hear WTI - that's an acronym for West Texas Intermediate Crude. These are what we refer to as benchmark crude oil types.

There are many types of crude oils sold into commerce globally, probably in excess of two hundred different types of crude oil. They're usually specific to a region and they can be quite specific to property, such as a high sulfur crude oil, low sulfur, and heavy crudes, and -- and light crudes.

So, this map on the right is just displaying the crude oil -- some crude oil types by both density API gravity and sulfur content. And what you'll notice, in the bottom part of that chart, you'll see that there is West Texas Intermediate, the blue diamond right next to the green diamond, which is Brent. Very close together in density and essentially identical in sulfur content.

So, you could say that those two crude oils are interchangeable if -- for -- and that's why, in fact, they are benchmarks WTI for U.S. transactions of the (indiscernible) and Brent as the North Sea Crude that will be for other exchanges like the International Exchange out of London.

So, there are other benchmarks that are very important and that would be in the Middle

East. So, that's the Omani Crude. And, more recently, it's been coupled with the United Arab Emirates' Dubai Crude, and they'll probably do, like, a fifty-fifty split on the price.

So, people need to have a benchmark crude for what? Future markets. So, that's what they're for and they need to understand the properties because, if you're selling and you're likely selling a crude oil markedly different than some of these benchmarks, you will want to adjust your price accordingly.

Higher sulfur content - that's going to have to be discounted because refiners have to spend more hydrogen and energy to process it. Higher density - you're going to get less gassing components, more diesel components - maybe you want that.

So, the differential can be either a plus -- plus or minus. And there's other properties like the metal content, acid number, things like that that reflect refinery operations. So, they'll vary.

So, what has happened to prices? Well, for the longest time, since our last IEPR cycle, it was -- what's the price of crude oil? Oh,

kind of what is was yesterday and the day before and the week before and the month before.

If you notice, the lines of these go back to 2011. They are in this band of about $100 to $120 a barrel, and this is for Brent North Sea, but crude oil prices all behave in a similar fashion, up or down, and I'll show you that in the next slide.

But the takeaway here is they are stable, stable, stable, and then -- at a very high price, mind you, and then the collapse ensued.

So, why that change? And the collapse is not specific just to Brent North Sea Crude. It certainly is a global commodity so it affects all crude oil prices.

So, on this chart, Brent is in the red line, Alaska North Slope, which is about, you know, ten to eleven percent of our crude oil use in California now, the blue line - West Texas Intermediate -- Texas Crude, which we don't really use any of, but it's a benchmark crude for the United Stated futures transactions. And local crude oil - San Joaquin Valley, what you see is -- well, that's like always lower than the other crudes, and that's because it's a denser,

heavier crude. It takes more energy to process it, and a higher sulfur crude. So, it is traditionally discounted versus some of these other benchmark crude oil prices.

So, these are just the numbers. I won't dwell on them. You can look at them at your leisure, but the specifics on how large the drop has been - it's been fifty-nine, sixty percent, so this is really significant. I think the only other more rapid drop was in the latter stages of 2008.

We had a much bigger decline and that was -- happened to be -- coincided with the collapse of commodity markets in general. It didn't matter what it was - corn, tin, aluminum - they all really dropped off a cliff in 2008 in the latter half.

So, what could be some of the culprits behind the rapid decline or the plummet in crude oil prices? So, I'll talk about the demands side a little bit, and then a lot of supply side issues, and finish up with -- for at least this part, discussion on the relationship with currency markets that do have an impact.

So demands - so, the International Energy

Agency puts out a report every month and it's about -- it contains a great deal of information on global and regional crude oil supply and demand. So, they are always forecasting demand.

And so, if you look in the May 2014, sort of where they were talking about the third to fourth quarter of 2014 -- so, that's May of 2014. It's the -- really, the next quarter and the quarter after that, those are what their estimates were.

Fast-forward to the present day and, as Aniss was saying, no one really saw this coming for the drop in crude oil prices, they didn't really anticipate very well what the actual demand was going to be and, in actuality, it was significantly lower.

And that bottom bullet is about 630,000 barrels lower in 2013. It happens to be with the next slide, and that is global demand, year on year. So, the gold color you see demand compared to 2012, and 2013 was up 1.27 million barrels per day.

But, when you went to 2014, only half of that increased. So, significantly down from what IEA was saying, even in May, to a tune of in

excess of 500,000 barrels a day, sort of off-the-mark, if you will.

2015 versus last year is supposed to be going up a bit - a bit of a rebound. Not like a -- a, you know, 2013, 2012 increase. And this number has been revised upward very slightly with the March report that just came out - about 75,000 barrels a day. So, it's essentially a one percent increase now with the most recent estimate by IEA for this year's global crude oil demand.

So, with the high prices for all of those years, it certainly incentivized everyone and his brother to go drill for crude oil. And drill for crude oil in places that they hadn't maybe been doing a lot of drilling.

And why were they able to do that? And these are tight oil formations. Those are the -- the map on your lower right-hand corner, you see different colors - the yellow is the Bakken formation or Williston, in North Dakota, primarily.

You see the Permian, the dark olive green in Texas -- central western Texas. And Eagle Ford in central western Texas into central Texas

going in an eastward -- northeast fashion is that play called Eagle Ford.

These are tight oil formations as in shale and it is lighter density crude oil. So, hydraulic fracturing - it's been around since the 40s - being deployed in a large scale on these tight oil formations in conjunction with things like much improved understanding of the formation with 3D seismic mapping, high-speed computer programs to crunch all of these numbers to better guide where one drills.

And extended reach horizontal drilling, upwards of two miles horizontally from your drilling pad, has allowed drilling companies to now drill for six wells from a single drill rig. So, the efficiency of these drill rigs has gone up and a number of dry holes has gone down. And so, this has allowed for the -- the development -- significant development in these tight oil plates.

So, this chart shows the oil increasing from these three most prominent oil plays, not natural gas, and you wonder, well, what are these other numbers up in the upper left-hand corner?

These are all over a million barrels a

day production from specific fields and these are referred to super giant fields globally. So, have really only been basically a handful of these historically, and right now, in the United States, there are three of them.

So, that's how remarkable this turnaround in crude oil production has been in the United States. So, as a consequence, crude oil production in total from all areas is now at its highest level since May of 1973.

Will it get and surpass the all-time high mark of ten million barrels a day set in 1972? Maybe. It'll be close. I'll show you why it might not quite get there, but it certainly isn't slowing down yet, according to these statistics from -- the latest multi-statistics available from December.

So, to separate this out into specific states, and you see the big increase certainly is from Texas - 2.3 million barrels a day compared to January of 2010. And then, North Dakota, the rest of the U.S., and California - about the same.

So, not much activity in the shale -- Monterey shale that you've read about in the

paper in California - really the same level of production.

But, that's actually an improvement from what California production had been doing - declining at a rate of two to three percent per year. So, that decline has certainly slowed, plateaued, and -- and gone up just a little bit.

COMMISSIONER McALLISTER: Hey, Gordon, can I ask a question? I'm just about -- so, this technology -- I mean, it's incredible. Everybody's probably just jaws dropping on just the turnaround here. So, that's an -- be an -- been enabled by this technology.

Where else is this being applied or likely be applied? I mean, you know, in the natural gas arena, certainly it's giving the U.S. economy a huge boost and kind of a competitive advantage, if you choose to look at it that way. At least on the near term on the natural gas front.

I guess I'm wondering what other economies or regions of the world this technology may provide, you know, additional resources. Basically, unlock additional resources. I mean, it's dependent on the geology in large measure,

right? So, where else?

MR. SCHREMP: Yes. Tight old formations, shale oil, and shale gas does exist in other parts of the world. This can be in Eastern Europe. It can also -- it is in Eastern Europe -- these formations. It's in China. It's in Argentina.

So, there is shale resources in these other areas. The likeliest candidate to show a -- a rebound in crude oil production would be Argentina. The shale -- there are companies -- international oil companies are -- had been bidding and acquiring parcels with the government's permission in Argentina, and been conducting operations.

So, it's anticipated that that would be one of the primary areas in the -- in the world where you see some additional tight oil production increase as a consequence of hydraulic fracturing.

Other areas have not been as successful in Europe in some of the early production wells. And there may be some other good plays in Southeast Asia, however, the most -- one of the most important factors regarding development of

this resource has been property rights and laws governing mineral rights.

And so, in some of these other countries, there is no such thing for the property owners, so who does the entity negotiate with? And how to do -- so, how do you work through those kinds of ownership or non-ownership issues?

And so, that's one of the -- I think it would be a barrier for greater application of this kind of technology in other parts of the world. You also have to look at an infrastructure for once you start developing wells and bringing the oil to the surface or natural gas, how do you then deal with it?

So, if it's a brand new area, you're -- you're into sort of a more expensive regime of how you then convey the oil and natural gas to get to a, quote, "market" for your infrastructure.

Argentina -- where they're looking for or developing shale oil in Argentina is within an existing area of oil development for many, many years has an extensive infrastructure system of pipelines -- gathering systems, and so it's highly suited to have both an infrastructure,

property rights, and any laws governing extraction and royalty payments.

So, that's no surprise while you see some international oil companies now trying to deploy this kind of technology in that international location.

COMMISSIONER McALLISTER: Thanks for that. It's helpful.

MR. SCHREMP: Okay.

So, globally, where has oil production changed? They changed, either a lot more or less? Well, clearly, the red bar. Why high -- why is it highlighted in red? It's the United States.

So, this is the average for 2008 and the average for all of 2013. So, if you stick in 2014 to this number, that chart will go up a little bit more for the United States. And you see -- I mean, it's -- it's much -- it's more than Saudi Arabia, Russia, Canada, and Iraq combined - this increase.

So, very remarkable to -- back to Aniss's point, no one really -- few people saw the price collapse coming was because of how dramatic a change this is on the -- on the supply side.

So, now we'll talk about how those two interact - the demand and the supply side. So, this -- this chart is quarterly - covering 2013 and 2014. It's global demand for crude oil in orange and global supply in blue.

So, in the first couple of quarters, about in balance. And then, you see, well, they started to get a little more demand. Third quarter, fourth quarter, above and beyond the supply.

That was driving -- helping to sort of sustain the elevated prices in the latter half of 2013. But then, you started to see the imbalance go the other way - oversupply. Too much oil. What am I going to do with this?

Well, you're going to have to discount it. You're going to have to stick it into storage. And so, that got pretty extreme in the latter half of -- or the second quarter of 2014. And that just happens to coincide with when the price collapse began in June of 2014.

And so, this oversupply situation has continued. I believe IEA is forecasting an oversupply for the first two quarters of 2015 - not on this chart. But then, that situation can

start to change in the last half of 2015, and I'll get to that in just a little bit.

So, OPEC, of course, saw prices plummeting. Some countries depend on their crude oil sales for an extensive percentage of their revenue for government programs. And so, there is a concern about trying to do something to rein in or halt the slide in 2014.

So, after Thanksgiving last year, OPEC got together at their meeting that was scheduled in advance and could not come to an agreement. They primarily couldn't come to agreement because probably Saudi Arabia felt, why should I be the one to cut production, lose revenue to shore up your price, if you do nothing?

And so -- and there was an attempt to get some other very important oil production and exporting countries, like Russia, to also maybe help and -- and voluntarily reduce some production. So, no-go on that front and the prices continue to decline.

So, Saudi Arabia and other OPEC members also look at this as maybe sort of, since they couldn't get cooperation, also looking at it from a different perspective, like, well, we'll just

let the market continue working, it gets in oversupply mode, the price will drop.

There are high producers out there -- high-cost producers. There are moderate-cost and low-cost producers. Certainly, Saudi Arabia is on the low-cost production category. So, there's a belief that ultra deepwater exploration production is much more expensive to develop. It certainly is.

Shale plays are usually much more expensive to develop. And so, in time, there won't be as much drilling and then production will plateau and start to decline, and then you'll have a rebalance of global supply and demand and a price recovery.

So, in the United States, unlike a lot of other countries, you're rarely not going to be able to export your crude oil, except under specific exemption categories. One is the crude oil coming from Alaska, actually, that goes down to Valdez Harbor, you can export that.

You have to get an export license, but it's not a -- a prohibited movement. But, if you're going to do that, it has to be in a U.S. Jones Act vessel. So, last -- late last year,

there actually was a -- a -- you know, a couple million barrels that left Valdez and went to Southeast Asia of Alaska crude oil, because you can do that.

But, it is usually a more expensive source of supply to some of these other markets. California has had on the books a while to be able to export 25,000 barrels a day of heavy crude oil. There were really no takers in quite a while.

Part of the challenge is, here, that heavy crude oil can be, in some cases, actually transported to a refinery in a heated pipeline. So, then, how are you going to load this crude oil, and then you either keep -- try to keep it heated on -- on the voyage somewhere else when you export it, or its destination.

So, unlikely, someone will try to do that. You can't really take that oil and blend it with other crude oils. You're not allowed to do that with this export restriction that's in place.

So, there's been lots of talk in the press about, hey, lots of production, sort of running out of places to use this. Shouldn't

this export restriction be revisited? And so, the dialogue continues, but, as it stands now, it hasn't been lifted.

You may have heard about some companies that receive permission to export condensate. Well, basically, they're taking crude oil that has a lot of natural gas liquids entrained in it. This is like Eagle Ford and they get some of those natural gas liquids out, and then that crude oil can now be exported through license.

But, that's a limited amount - maybe five to six hundred thousand barrels a day, so smaller in the grand scheme of things and it's not expanded to be just an open end. You actually have to run that through almost like a distillation unit now and not just heat it up a little bit.

So, no export capability, really, and lots of production, as you saw, and so, lo and behold, no surprise - put it into storage. (Laughter.) And put it into storage in a big way in the United States.

And so, these figures are from the weekly Energy Information Administration data. And this information -- these -- this crude oil does not

include what is housed in our strategic petroleum reserve.

That's nearly 700 million barrels - 690 million, to be exact. That's excluded from the statistics. So, this is basically commercial. And it's more than that. It's some pipeline, line fill, and things like that, but, however you measure it, it's certainly way, way up and it's well beyond the top of the five-year high/low band. And it's the highest level since the 1930s -- well, since 1930.

And it's getting a little bit higher. I think it's up another -- it's up another 10 million barrels, it's 450 million as of last Friday - an update of these statistics. And so, it's getting closer to the all-time high record. It's now within less than about 90 million barrels of that.

So, I don't know if it'll get there or not, but that'll be interesting. So, if you're, say, forced to put it into storage because you can't sell all of your crude oil, you also look at what the futures price is.

And the futures market is rising. It's getting -- and that in large part because the

current price pushed down. And so, the latter part of this twelve-month into the future curve is going up higher than the current price.

So, this is called contango market. And that means you can do a play -- a storage with crude oil and, if the costs per month of storing it is less than the raise in the market with your futures contracts, you can make some money.

And so, people can be incentivized to put a little bit of additional crude oil into storage other than sell it because they think the value of it is going to be higher in time than it is right now, so I'll just wait.

There's also, in -- in the popular press, you'll hear a lot about, oh, the dollar is up and crude oil is down and vice versa. There is this relationship between the two, an inverse correlation or a negative between the U.S. dollar exchange rate to say, the euro, and what the actual price of crude oil is.

So, this -- this has been talked about an awful lot. The correlation is very strong post-2001, but before, not really. (Laughter.) Not really whatsoever. So, that's interesting - not before, but really now? Oh, okay.

So, the -- the sort of the higher level is that, if you look at a country that has non-U.S. -- non-dollar currency, say, the yen, not -- and -- is so -- they can -- it'll fluctuate according to the dollar, be devalued, or, if it -- declined dollar, the yen's more powerful, their purchasing power increases, so they can buy more crude oil and so they can -- that -- India and Japan can maybe put pressure on price, vice versa. But strengthen the dollar now, the opposite impact.

So, that's -- that's sort of a more basic, simplistic understanding of this relationship. However, there's been more work done in this area, which is good because, frankly, the relationship is probably much more complicated than that.

There are -- there is much going on globally in monetary policies. There's much going on in the futures markets with regard to positions by hedge funds and how much money they have in the futures market asset, especially crude oil.

Either a long position or a short position at some point has to be covered and can

increase demand and you have money flowing into different commodity markets - money flowing into gold, money flowing into the stock market, money flowing into currency markets, money flowing into crude oil futures markets.

So, these kinds of things - these interrelationships and money flows - seem to be having -- be able to be shown to have more of a longer-term impact, if you go -- go back further in the data, and could be a greater explanatory factor.

And so, it's almost like crude oil -- I think the authors' bottom line is that it's more behaving like a financial asset - these crude oil markets. So, you're welcome to go download a copy of the paper there.

So, it is -- it is an interesting area, but, you know, just tail wagging the dog (laughter), though, you know, vice versa. So, it's -- it's interesting, but it's usually -- it's probably the tremendous increase in supply and a modest change in demand globally that was unexpected is really the big, big drivers here for that.

So, the collapse in crude oil prices -

we'll look at what that meant for imports and what that meant for drill rig deployment.

So, imports - if I produce more, I don't need as much. And so, that's down, and that's about a little over seven million barrels a day and this is the lowest level of crude oil import since 1995. And that's expected to continue to decline as long as domestic oil production keeps rising.

Now, the caveat to that is, if these oil prices stay low and maybe go -- drift a bit lower, U.S. refiners may be incentivized to produce even more above and beyond what they're -- they need for local markets.

And exports - they've been doing this. In 2013, they set a record for refined product exports to foreign countries. And in 2014, they broke the record. So, all time high quantity of refined gasoline, diesel, jet fuel, exported to foreign countries, because they could be more competitive in those markets versus other foreign-based refining assets.

Drill rig deployments - you could say there's been an equal collapse of drill rigs being deployed looking for oil - not natural gas.

This is oil, but there's been a decline in natural gas, as well.

And so, you see here that they're down significantly - almost fifty percent from their peak in October. And the biggest declines are in the Permian Basin - I showed you, in west Texas, Eagle Ford, in Williston, is another term for Bakken. So, that's where companies have pulled up their stakes, idled rigs, moved on.

And where drilling is now occurring is going to be more finished holes being drilled in areas you have a high degree of knowledge, you know you're going to be getting a well that's producing three or four hundred barrels a day as soon as it -- as it's completed to get a cash flow sufficient to cover your costs and continue some additional drilling.

And so, redeployment of rigs. So, that's why we yet still haven't seen a plateauing and a decline in some of these areas of their crude oil production. It does take a couple to several months.

So, stay tuned. It's -- it's almost inevitable, as one would say, but it's not immediate, certainly. And even Canada -- I think

you've seen, you know, these rigs are down almost -- over seven hundred. For Canada, for oil, they're down for the same period of time, about - since the peak in October - about two hundred fifty drill rigs.

So, this is not isolated to the United States. It's in Canada. It's in international drilling statistics. It's in ultra deepwater platform statistics. Those -- those large, large structures being idled in cold -- what's called cold stacking. So, that -- that's going on.

So now, our final set of slides is sort of what other issues could be in play that may affect near-term prices -- near- and medium-term prices. And we'll certainly -- what EIA is going to be looking at when they have to come out with their 2015 energy outlook.

And so, that happens to be with -- global demand for crude oil is seasonal. It's kind of, you know, we all know sort of gasoline demand is seasonal. It goes up rising into the spring, peaking summer, and falling off a little bit.

Well, crude oil is -- is the highest demand is, like, almost always the last two quarters. This is based on sort of refinery runs

are higher because you're not doing plant maintenance normally those last two quarters.

Demand in North America -- in the Northern Hemisphere is higher for refined products - heating oil driven in Europe, Southeast Asia, place like that. So, it's always up in the last two quarters.

So, that is rather significant for -- globally, it's a two million barrel a day increase. That's a lot. And so, that's what's sort of on the books, what they think is going to happen in the last part of 2015.

So, that's why you hear a lot of people in the -- in the press talking about, well, crude oil prices will remain soft until the latter half of 2015. This is why they talk like that.

And North America, which used to be sort of flat, flat, flat, is also looking at a strong contribution - 620,000 barrels of that. Second quarter versus fourth quarter is from North America alone. So, that's thirty-one percent.

So, that's a change from what it's been over the last couple of years where demand has been more flat, I would say. And that's more muted in that rise because of the economy, but

now the economy's improving. So, that outlook has changed a bit now.

Another area to look at is there's some regions that aren't producing as much crude oil and exporting it as they would like due to other issues. One of them could be Iranian crude oil that, due to sanctions, is more difficult and a challenge to get into the open market.

Certainly Syria, because of the violence in that country, has decreased their exports, although they were rather modest. But a very important exporting country that's not doing a lot of that recently is Libya.

So, the violence continues, post-Gaddafi era, and there's been lots of attacks on infrastructure to either gather producing fields and, more importantly, the -- the distribution terminals at the marine level -- held by two different parts of -- of political entities that claim power in Libya.

So, there's lots of -- of stress in this system, and so, their abilities to get oil to the market -- to the global market has been kind of impugned. And so, I don't think that's going to change in the near-term here, but it certainly --

this is something, if it does, they do get some piece of stability, as least for exporting crude oil and getting additional revenue.

But you could see, drilling downward, pressure on crude oil prices. I mean, that's sort of a million barrels plus spent on export capability that's just basically sitting there. And this is really a -- a light oil -- more of a light oil, not a heavy oil that was primarily being taken up by European refineries.

The final factor has to do with all that storage, all that crude oil going up and up. It's not infinite. (Laughter.) It's finite where that can go. EIA has done a really good job looking at what those storage capacities are for crude oil, and they publish a report twice a year - so, the most recent data.

And then, an update in February for February 20th is that there was about forty percent spare storage capacity for crude oil. And, well, that got eroded a bit to 37.2 percent as of, you know, a couple of weeks ago.

And, actually, the most recent data - that was eroded a bit more. It's about 35.8 percent now. So, the number is -- is sort of

being eroded by about a million barrels plus a day.

But, that's likely to change as refineries come out of planned maintenance. In California and some other areas, they're going to take up a bit more crude oil and we'll see if there's some sort of change in price, what happens, but -- but this is certainly something that could continue to put downward pressure on crude oil prices moving to the rest of 2015.

So, I'd be happy to take any questions at this time.

(No response.)

COMMISSIONER McALLISTER: Thanks, Gordon. That was great.

MR. VAN DER WERF: Hello. My name is Ysbrand van der Werf. I work in the Demand Analysis Office here at the Energy Assessments Division in the Energy Commission, and I'm going to be giving a talk about the inputs and assumptions that we make to get price cases for use in our transportation forecasts.

Now, before we look at a number of forecasts from different agencies - EIA foremost amongst them -- and what we plan to use is the

EIA Annual Energy Outlook of 2015 projections and, you know, we'll have three scenarios, the reference or the high oil price and the low oil price.

Currently, however, EIA usually has their preliminary projections available in January or February. As of now, they are not yet available. So -- well, let me review this -- this quote from this March issue of Platt's Energy Economist that makes it clear just how much is going to change in what I present to you in the next few minutes.

> "It is at times of rapid change that forecasting becomes most difficult. If history is any guide, current forecasts are more likely than others to be subject to major revision as the year progresses."

And that is particularly true for what I am about to say, as we'll see in a moment.

Now, for historical data, we are using -- it changed from past practice. We're using the West Coast composite refiner acquisition cost of crude oil and we also consult with Commission experts on prices for natural gas and hydrogen and electricity rates. And we also want to

solicit input from workshop -- workshop participants today.

Now, this is a very -- this will be completely revised. This is the refiner acquisition cost that was put together from last year's annual energy outlook from EIA, and from their current short-term energy outlook.

So, now, last year's energy outlook - they had a high case, a mid case, and a low case, and the low case actually turned out to be pretty close to what actually happened.

So, the work we -- that I -- you see here is based on the low case, and also the short-term energy outlook, which only goes out for two years - 2015 and 2016. And so, these -- I mean, in particular, the high case and the mid case are -- are very close to each other and -- but we -- we really have nothing else to work with at the moment. And they are sure to be revised pretty substantially when we get the EIA forecast.

And here we see the same forecast for oil -- well, this is in -- in -- and we have natural gas added and the -- we changed the units to 1,000 BTUs so that the oil and the natural gas

prices are in the same unit.

And, as you can see, if you look at the -- the vertical axis on the left - that's 2014, last year. The oil prices dropped substantially, so natural gas is a much smaller cost advantage than it had in the past.

Now, this natural gas price is from the old forecast. It has not yet been updated. And you -- we would see it -- expect to see, for 2015, certainly, that that will be -- the price will be lower for natural gas than it is now, but we don't have a forecast fully in place that we can use yet.

Now, these three items here are what -- are combined to form the retail price for these fuels. We begin with the forecast of refiner acquisition costs, or RAC, in cents per gallon, which is what we got from EIA -- or will get from EIA.

Then, we establish a -- the margins - sort of a -- the markup, the intermediate process, how it goes to -- through the refinery to the wholesale rack to the retail outlet. And we do that for gasoline and diesel and jet fuel. And then, finally, we add in California and

federal taxes and fees - some of those are excise taxes, a fixed amount, and others are sales taxes, a percentage.

Now, let's see, we hold -- we generally hold things constant in real terms for fuel margins and taxes. The carbon price we are using is a preliminary update. And other things listed here will be -- will be updated.

Our -- let's see, there's -- well, we will be updating the margins, although we -- we hold them constant in real terms. We'll have new margins. The tax rates we use are the -- the correct ones that will be in place.

And here is a graph of the historical - this is not a forecast. These are the historical RAC price on the West Coast - that's the purple line. And the margins - the RAC-to-retail. So, for the refinery acquisition costs to the retail margin, how -- how big is that?

Well, the blue column indicates how big that is in any given year, and that varies from fifty cents to about a dollar. And this has not been updated.

Those of you with very good memories will -- may recognize that this was the identical

graph that was used two years ago. And, again, we don't have the data to update this at the current time.

Now here, we have something that is certain - it's taxes. These are the tax rates that will be used in our final forecast and I list them here. Hopefully, I -- I believe they're all correct and they are the rates that will be effective as of this coming July.

Now, Slide 9, here -- this is the first of our scenario outputs. This has real and nominal gasoline. Nominal is the dashed line. And, in all these graphs, the orange line is the high-demand case, blue is mid- and green is low-demand.

And this will be the benchmark for most comparisons with other fuel scenarios and they start -- it's -- well, right now, the -- oh, and these -- the real prices are in 2012 dollars. So, the dashed line -- right now, I paid $3.20 the other day. So, that's a pretty good starting point for 2015, although we will certainly see things change from there.

And next, we have the other petroleum-based fuels - diesel and jet fuel. These are

real prices. So, diesel -- the price for diesel is -- is a bit higher, as you might expect. The mid-case -- mid-demand case is, what? About $3.20 for gasoline - about $3.50 for diesel, and jet fuel is quite a bit cheaper.

And turning to some of the emerging fuels --

COMMISSIONER SCOTT: I have a question for you --

MR. VAN DER WERF: Yes.

COMMISSIONER SCOTT: -- before you go on, which is the -- where is -- where would the fuels under the cap be incorporated into this? I'm kind of looking at Slide 8. Are -- are you including that in -- in --

MR. VAN DER WERF: I'm sorry?

COMMISSIONER SCOTT: The fuels under the cap -- for -- for the cap-and-trade program?

MR. VAN DER WERF: Oh, those -- that -- so, you mean, like, the carbon price?

COMMISSIONER SCOTT: Mm-hmm.

MR. VAN DER WERF: Yeah. That's incorporated separately. It's not a -- it's not a tax on the fuel that the consumer pays.

COMMISSIONER SCOTT: Right.

MR. VAN DER WERF: So, that is -- so, the third bullet here, the add California, federal taxes, and fees. That's what's on Slide 8. And here, the -- oh, I don't actually mention where I -- it's -- that's added in with margins for regular -- for gasoline and diesel.

COMMISSIONER SCOTT: Okay.

MR. VAN DER WERF: So, it's treated separately for the taxes.

COMMISSIONER SCOTT: Okay.

COMMISSIONER McALLISTER: That is explicit in there as a -- as a cost --

MR. VAN DER WERF: Oh, yes.

COMMISSIONER McALLISTER: -- that ends up in --

MR. VAN DER WERF: Yes.

COMMISSIONER McALLISTER: -- there. Okay.

MR. VAN DER WERF: It is.

COMMISSIONER McALLISTER: I just wanted to make sure.

MR. VAN DER WERF: Yeah.

So, this brings us to propane and a couple of biofuels. And -- so, for B5, we use the same scenarios as we use for diesel. B5 is

taxed the same as diesel. We assume it has the same price.

E85 - we -- the scenario prices we use are based on the energy equivalent price of gasoline. So, we take the price of gasoline and divide it by 1.37. We do not know of any E85 forecasts, although we would be pleased to learn of one.

And propane - surprisingly, EIA has stopped reporting West Coast propane prices and they did so over two years ago. So, we have no way to make a forecast of that and we would certainly be interested in learning of alternative data sources for that.

So, let's talk about the price cases, here, for these -- these other fuels. We -- we used the same fixed margin methodology that we did with the petroleum-based fuels.

CNG, compressed natural gas, and hydrogen fuels - they are both based on natural gas price projections from the Natural Gas Unit of the Supply Analysis Office. They have not yet been complete -- fully updated. And the same can be said for electricity prices. All those will come from our Demand Analysis Office.

And here we have the scenario output for compressed natural gas and hydrogen. Oh, let me -- I'm sorry. Let me go back. I've skipped a few things here.

So, for compressed natural gas, we used the PG&E hub price with different hub-to-retail margins for each case, and we add in an excise tax of 18.4 cents per gasoline gallon equivalent and 8¼ percent California sales tax.

For electricity, we have gasoline gallon equivalent conversions of the retail price projections from -- that are produced here at the Energy Commission.

And, for hydrogen, we use the same cases as the -- as for natural gas based on the PG&E hub or Citygate price. And, again, we use different margins for each case and we use a .39 multiplier to convert natural gas into wholesale hydrogen and we add in an 8¼ percent California sales tax.

And here we have the -- the output -- preliminary output from our models. So, gasoline -- in all these, gasoline is just the simple line. So, if we compare the base -- or, pardon me -- the mid-demand cases - those are in

blue.

Hydrogen - the cost of hydrogen is, you know, much higher than the cost of gasoline. And then, in the cost of natural gas is very low and that's consistent across all three scenarios.

Then, here we have electricity. And electricity, again, is much more expensive than -- than gasoline. So, again, these will be updated when we have new information.

Now, if we turn to cost per mile projections for new vehicles, you know, instead of -- I mean, this is really -- this is the main determinant of -- for vehicle choice and travel. It's more important than just the simple cost of the fuel. And some fuels, as we know, become a lot cheaper on a cost-per-mile basis than in the simple retail price per unit sold.

And, lastly, note that these graphs I'm showing here - do not assume any fuel efficiency improvements in hydrogen fuel cell or electric vehicles. We just don't have those at this time, but we will.

And so, here we have just some output for -- I mean, hydrogen and electricity, our expensive fuels. We compare them with gasoline

on a cost-per-mile basis and we see that the electricity cost drops sharply, the hydrogen cost does not.

And you'll notice the hydrogen cost - the lines with the marker. Those are fairly flat and a couple of the blue lines - the mid-scenario, the mid-demand case - that even goes up a bit. But, you know, we -- I mean, we do not have any fuel efficiency forecasts for hydrogen vehicles at this time.

COMMISSIONER McALLISTER: Can I ask a question just about the -- the -- well, I guess, what's the prime -- where's the hydrogen coming from? Where -- where is it being derived from in your exemptions here?

MR. VAN DER WERF: We assume steam methane reformation.

COMMISSIONER McALLISTER: Oh, okay.

MR. VAN DER WERF: That's why we --

COMMISSIONER McALLISTER: So, you --

MR. VAN DER WERF: -- based the price on the natural --

COMMISSIONER McALLISTER: Okay.

MR. VAN DER WERF: -- gas.

COMMISSIONER McALLISTER: I forgot that.

Okay. Great. I put it all together. But that -- there are scenarios that would vary significant from that, right?

In terms of, you know, sort of, if you talk to the some of the electricity demand folks, you know, they might say, okay, well, as we incorporate all these renewables, we're going to have a bunch of excess renewable that might be able to lower the cost of the -- they might provide a different feedstock.

They might enable a different feedstock for hydrogen. So, I wonder if any of that discussion is -- is going to happen in this forecast as far as -- could that be an alternative scenario?

MR. VAN DER WERF: Right now, we don't have any plans to do so, but we -- we could develop such an scenario if -- if there's a desire for us to do so.

COMMISSIONER McALLISTER: It's definitely one of the things that's being discussed pretty actively. I mean, in a preliminary form. You know, there's no guarantee that -- that the -- I mean, there's no crystal ball to say how big would that be.

But it certainly, as we contemplate how we go really high on the renewables front and how we're going to enable technologies to that allow the grid reliability -- that grid responsiveness, then, feeding that clean electricity into -- helping to electrify on some way, the transportation fleet. And hydrogen is one way to do that.

You know, is -- is -- our scenarios we do need to take seriously because they're -- they're going to play out in one way or another, so I think it's --

MR. VAN DER WERF: Yeah.

COMMISSIONER McALLISTER: -- probably good --

MR. VAN DER WERF: We can --

COMMISSIONER McALLISTER: -- it's good to

MR. VAN DER WERF: We could certainly --

COMMISSIONER McALLISTER: -- think about that for sure.

MR. VAN DER WERF: We can certainly add such a scenario or more than one if need be.

COMMISSIONER SCOTT: The other thing I would suggest here is to -- to stay in touch with the -- the Fuels and Transportation Division on

this because they have -- you know, we've -- we've funded, I think, fifty-one or fifty-four hydrogen stations and they have exact information on exactly how that hydrogen's going to -- to be made -- where that's hydrogen's is coming from.

We've got a thirty-three percent of that hydrogen has to be renewable, and so they'll have a -- they have a --

MR. VAN DER WERF: Right.

COMMISSIONER SCOTT: -- sense of kind of exactly what, at least for those first few stations, the -- the sources of hydrogen are -- are going to look for this, and so it'd be good for that to match.

MR. VAN DER WERF: Yes.

COMMISSIONER SCOTT: Or match as much as possible.

MR. VAN DER WERF: Yes. It would be good to work with them in general on --

COMMISSIONER SCOTT: That's right.

(Laughter.)

COMMISSIONER McALLISTER: They probably have some long-term -- they have long-range scenarios for, like, okay, once we get the kinks worked out and we have, you know, more bulk in

terms of, you know, a wholesale process and sort of more industrialization of this than they probably have projected some of those prices for it already.

MR. VAN DER WERF: Yeah. That's what's key here because we need -- you know, we have to have real market prices that we can use. So -- like, wholesale bulk is important, so.

(Laughter.)

And here we have -- we're just wrapping up here with three summary slides. This is for the mid-demand case. We just compare retail with cost per mile. The fuels are the same colors on each graph so you can see how much electricity -- how much the cost drops going from the retail price to cost per mile.

It's almost the highest to distantly the -- the cheapest. Hydrogen doesn't drop that much. Gasoline and diesel swap places, as we would expect to see.

And we see that in the mid-demand case and we also see it in the high-demand case and we see the same patterns in the low-demand case, although on low-demand we see - as we currently have it that hydrogen ends up being -- well, we

have no -- I'd remind -- we have no -- this assumes no fuel efficiency improvements for hydrogen vehicles.

That's why hydrogen actually goes up in this -- the cost of hydrogen actually goes up in this low-demand case, because there are fuel-efficiency improvements assumed for gasoline and diesel vehicles, but not for hydrogen. And that is something that will change when we have our final forecast.

And that wraps things up. Any questions or comments?

COMMISSIONER McALLISTER: Great. Thanks very much. It -- it seems like there's a lot of work to -- to sort of beat the data sources over the head and get the data --

(Laughter.)

COMMISSIONER McALLISTER: -- so that we can -- so that we can sort of make sure we're doing apples to apples across the board here.

MR. VAN DER WERF: Yeah. And this year it's particularly difficult because, as Gordon was discussing, all the changes --

COMMISSIONER McALLISTER: Yeah.

MR. VAN DER WERF: -- that have occurred.

Many forecasts are being -- are very late, so a lot of the data that we ordinarily have by now, it simply isn't available, so.

COMMISSIONER McALLISTER: Right. Okay. Is that a federal issue --

MR. VAN DER WERF: Well --

COMMISSIONER McALLISTER: -- for the most part?

MR. VAN DER WERF: For EIA, it is, and that's what -- where we got our gasoline and diesel price from and, without -- without those, we don't really have a baseline for comparing the other fuels, so. And we also cannot update the -- the margins - the RAC-to-retail margins.

COMMISSIONER McALLISTER: Right. Okay. Then, on propane, there's just kind of no -- there's not a good scenario -- there's not a sort of good alternative, it --

MR. VAN DER WERF: No.

COMMISSIONER McALLISTER: -- sounds like.

MR. VAN DER WERF: We -- we don't know of one at all. I mean, EIA changed the way they report propane prices I think three years ago or so. And they just don't report anything for the West Coast, so.

COMMISSIONER McALLISTER: Okay.

COMMISSIONER SCOTT: Just out of curiosity, is that because there's not enough use or what -- why would they just drop propane?

MR. VAN DER WERF: I -- I don't know. It may be that there are a small number of suppliers and -- or it's not -- it's not connected to the -- there are propane networks -- pipeline networks in the rest of the country. Those may not make it across the Rockies.

And, if you have a small number of suppliers, perhaps there are some confidentiality issues. There isn't as much of a -- and Gordon's turning around like he has something to add here. Do you?

MR. SCHREMP: Yes.

(Laughter.)

MR. VAN DER WERF: Would you like to come up here --

MR. SCHREMP: No. You know --

MR. VAN DER WERF: -- or stay right there?

MR. SCHREMP: -- I think I can talk here. This is Gordon Schremp.

Yeah, propane the EIA talks about is

really a winter fuel, it's a heating fuel. That's their focus and Ysbrand's right. There are pipe -- propane pipeline networks, mostly upper Midwest and Northeast.

So, their -- their reporting is -- is centered on winter fuel, heating oil, during the -- during this portion of the year and so they had a lot of prices in those regions and really not much of a heating fuel out here. There is some that goes on in California, but it's really not a transportation --

COMMISSIONER McALLISTER: Yeah.

MR. SCHREMP: -- pricing and tracking that EIA is doing.

COMMISSIONER McALLISTER: Okay. So -- but, I mean, I'm gathering -- even so, it's definitely a problem in the transportation sector, but, just in general, they're not reporting propane prices out here at all.

So, we don't have, you know, for, you know, rural places that depend on propane for cooking and eating in many cases. I mean, it's a small portion of our economy -- you know, our built -- built environment, but, still, we don't hear -- I guess I'm hearing that we don't even

have prices for that.

MR. VAN DER WERF: Correct.

COMMISSIONER McALLISTER: Okay.

MR. SCHREMP: But, but -- and this is Gordon again -- I think -- I mean, there are -- there are sources of propane pricing information that I think are available for purchase.

COMMISSIONER McALLISTER: Right.

MR. SCHREMP: I think what Ysbrand's been talking about is -- is prices that other stakeholders can also view. They're sort of transparent. You can go online and download them and see them yourselves. But -- but, there are certainly propane pricing sources that we could look at to -- you purchase that we could use as the basis for the forecast.

COMMISSIONER McALLISTER: Yeah. I guess that depends on whether they're relevant for transportation in this case or -- or more broadly. I mean, you know, we don't necessarily need to know what the trucks driving around loading people's tanks are doing. But maybe - I don't know.

Thanks. I don't have any other questions.

MR. VAN DER WERF: Okay.

COMMISSIONER McALLISTER: Okay. Great. Thanks very much, Ysbrand.

MR. VAN DER WERF: Okay. Next, we'll have --

COMMISSIONER McALLISTER: Oh, do we have a -- do we have a public comment on this? Should we -- Heather, should we do that at the end or should we -- you know --

MS. RAITT: I just had a quick -- quick comment.

COMMISSIONER McALLISTER: Yeah. That'd be great. I mean, I don't know if we want to stick around to the very bitter end.

(Laughter.)

COMMISSIONER McALLISTER: So, maybe we just take it now. Thanks.

MS. BLIXT: Hi. Thank you. Amber Blixt, with the Independent Energy Producers Association.

I just wanted to quickly comment and say that we echo and support your recommendation to kind of look at the -- how the intermittency and renewable fuels can help look into the nexus between transportation here and how renewable

energy -- developing a scenario for kind of looking at how that can work with fueling the hydrogen or electric vehicles. How that renewable energy nexus can work.

So, we would -- we definitely support and appreciate those comments of the Commissioners. So, that's all. Thank you.

MR. VAN DER WERF: And next, we'll have Tom Carlson, who will be talking about vehicle attributes.

MR. CARLSON: Good midday. I guess it's not quite morning, and so I'll try and stay on schedule. My name is Tom Carlson.

I'm a scientist at Sierra Research and, as noted here, I'm going to talk about the forecasting of the vehicle attributes that support the demand modeling elements as Aniss touched on earlier.

What a -- what a climate to try and do attribute forecasting as it always to be, as Gordon and Ysbrand just discussed, with the volatility of crude oil prices. I believe Gordon touched on as it relates to the potential delay in the IEA forecasts becoming available, especially the long-terms forecasts, it's just

what role the -- the potential for shale extraction is long-term and how that will affect prices.

So, that's just one example, but here we are past the halfway point of what we in California call the Pavley light-duty fuel economy or greenhouse gas emission standards or their federal equivalents that have been harmonized to them.

And -- and we're seeing developments that suggest that manufacturers are -- are generally able to build additional technology and -- and, at this point, get it in the marketplace where it's being purchased and we'll talk how that affects and plays into the -- the forecasts that we prepare here to support the broader demand analysis that CEC is doing for the IEPR.

I just want to point out, though, as we're -- we're starting here is that -- that -- what I'm going to discuss today will focus on our data sources and assumptions. And the forecasts that we'll be preparing here and in the near-term are draft forecasts, if for no other reason than we'll be updating the component that depends on the fuel prices when the EIA turns around their

forecast for this year and staff can utilize them.

But, we'll also want to take and entertain comments or -- or suggestions for things to look at in addition to those changes that we know we need to make.

I'm going to begin by just giving you an overview of what I want to focus on. I'll provide a little bit of background and discuss some of the key sources in the scope of our analysis, and then go into more detail that we'll discuss separately for attributes for the light-duty versus the heavy-duty vehicle fleet.

As I'm sure most of you know, and it was touched on by Ms. Bahreinian, the vehicle attributes include things like price, fuel economy, the number of different model configurations offered, as well as the number of performance and utility metrics, like how fast a vehicle can accelerate, how much it can tow.

For emergent technologies, how far can it go on a tank of gas or a charge of electricity. And these are used, as we noted earlier, to support the portion of how consumers value these different attributes of vehicles as they make

decisions to purchase them and additional technologies penetrate the marketplace.

The structure for our developing these attributes centers around the structures of the DynaSim model that was mentioned earlier. For the light-duty fleet, it encompasses eighteen separate vehicle classes that are similar to those that were shown in -- in some of the slides from -- from Gene and Aniss that depict the light-duty fleet, both by size - large, midsize, compact cars, SUVs, vans and trucks, and size categories within those.

And the trucks and the cars are separated because of the different utility that each of them offers. Then, there are sixteen heavy-duty classes that are being used in -- in that portion of the DynaSim modeling.

And then, we also have to develop attributes or -- or account for them by what we call technology or fuel groups and you're all probably very familiar with them.

They include, in addition to conventional gasoline and diesel technologies, include these others that I've listed here - natural gas, E85, electricity, and, in particular, those

technologies that are associated with programs -- regulations we have here. And say, like, the ZEV regulations - so that would include the plug-in hybrids, pure electrics, and fuel cell vehicles.

For the light-duty fleet, we model all of these attributes separately, and I'll talk a little bit later about, given the tools that we're working with staff to do the heavy-duty modeling, how some of these attributes are -- are sort of grouped into a composite.

I will continue along. This next slide is just a summary of what the scope of this analysis entails and -- and key sources and -- and elements that we're -- we're going to account for.

The light-duty forecasts are going to be based on this largely National Academy of Sciences "Transitions to Alternative Vehicles and Fuels" study and the associated modeling package called LAVE-Trans.

We used that for the last IEPR. We believe it's a very robust, well-conceived, thorough study, and it offers -- with this modeling package driving some of the elements of it, it offers a -- a potential to look at

scenarios beyond those that focus only on currently-adopted regulatory policies, which might be of interest at some point.

It will incorporate accounting for the ZEV amendments here in California because the originally-developed NAS work did not. And then, the other thing that we're doing under this IEPR is adding two more years of historical data from model years 2012 and 2013 to our historical database upon which we build our forecasts.

For the heavy-duty fleet, we're going to focus initially on the most important attributes, which are fuel economy and price. As a starting point, we're going to use ARB's just-released EMFAC 2014 model to generate estimates of fuel economy by vehicle class, fuel type - for those fuel types that the model addresses, which are largely gas and diesel - and model year and the projections that it contains going out into the future.

I'll talk a little bit about how we're going to develop truck prices. They're not as easy to assemble from content providers that are historically focused on the light-duty fleet, but we have a -- we have found some data.

And then, the -- the tool that we're going to collaborate with staff on that will help us develop estimates of market penetration for -- for different technologies within the heavy-duty fleet beyond diesel and gasoline is this "Trucks 5.1" model, developed by the National Petroleum Council. I'll talk about all of those elements a little bit more in a bit.

COMMISSIONER SCOTT: I have a question for you on the -- on the light-duty, but it -- it might be coming up in the next couple slides, which is that on the zero emission vehicles, especially the battery electrics and the plug-in, that space is changing really fast and it's kind of been changing over maybe the 2013-2014 timeframe, and so do you have a way that you'll be able to capture that type of information?

MR. CARLSON: Yes. One of the -- you'll see a bullet a little bit later, but one of the things that we've done, in addition to gathering historical data for those two model years that go into our historical database, 2012 and 2013, we've pulled fuel economy into the available price data through even model year 2015.

And so, we're going to be able to use

that information about some of these technologies, particularly here in California, that are starting to -- to penetrate the fleet.

A good example would be the fuel cell vehicle that's not being offered by Toyota, the Mirai, and I know, for example, it's not a -- it's not a ZEV vehicle, but we've seen technology effects from things like Ford's new all-aluminum pickup that we're going to try and account for.

So, as I said, I'm going to start to drill down into some of the more important elements of the -- the light-duty fleet first, and then we'll transition to details on the heavy-duty fleet.

And, Ms. Scott, I think you just preempted this slide quite well.

(Laughter.)

MR. CARLSON: And, as I said here, we -- we have historical data and we're compiling it for every vehicle model and power train from several different data sources where these data are generally much more widely available for the light-duty vehicle fleet.

And then, what we have to do is take this

model-level data and tabulate it up into these vehicle classes and technology groups that the CEC model uses, and -- and we do that, at least, now, based on sales data that we have for the U.S.

One of the things that we've discussed with staff is the possibility about doing an estimate at some point where that's based on a California sales waiting. But, right now, we're -- we're doing our initial forecast based on U.S. sales.

And then, as I noted in response to your question, we've -- we've pulled data for these next two model years and particularly for the emerging technologies to -- we'll be able to sort of launch our forecast better going forward.

An overview in what we do in preparing these forecasts that -- that tie to their fit into the demand modeling is, right now, we're going to develop forecasts out through model year 2026, and do those separately for sets of scenarios that staff has provided as -- as a function of different long-term fuel price, economic outlooks, and, right now, for a single regulatory policy scenario, which is basically

all currently-adopted regulations at both the state and federal level.

And, as I noted in the second bullet there, that would be CAFE, greenhouse gas, and RFS standards at the federal level, and then those elements that we have here in California, some, like the low carbon fuel standard, don't really affect our attribute forecasts because the LCFS is largely going to affect volumes of different fuel types.

That's not really an attribute that we forecast, but we'll want to be able to -- when we're making separate estimates of what we think are sales of -- of vehicles behind our forecasts, in particular for the ZEV regulation, ensure that we can try and track those into the attributes that we're developing estimates for and I'll talk about that particular element in just a bit.

And, as I noted earlier, our fuel scenarios will be updated once we get new long-range crude forecasts from EIA, expected hopefully soon, and, again, the primary source for these forecasts will be this 2013 NAS work and -- and modeling system.

My fellow presenter, Mr. Melaina, from

NREL, I took the liberty of looking at some of his material and, just to avoid future confusion, he'll use the term NRC, which stands for the National Research Council. It's the same entity, it's just to avoid confusion as he discusses some of that work.

We will also, even though I didn't get it listed on that particular slide, the sort of overlaying some elements of attribute forecasts from the EIA's 2014 Annual Energy Outlook.

I'll quickly go through the most important elements of the -- elements of the NAS study. One thing that we were attracted to is that, as I alluded to earlier, they didn't just look at a cases that reflected current regulatory policy, which is here referred to as their reference case and that we're at least using initially, but they also set up estimates of future effects of fuel economy and prices and technology penetration for cases that reflect specific levels of additional light-duty vehicle reductions.

They are not necessarily tied to any particular regulatory policy, but those targets that would be supported by regulations that would

get to those levels.

And this is one of the reasons why we kind of continue to want to use this source, because it gives us a more efficient tool, we think, to look at cases, if we want to evaluate anything beyond policies that are currently in place.

Their technology penetrations are grouped into two categories where they looked at powertrain improvements, based on modeling that was largely performed for the EPA 2017 to 2025 greenhouse gas regulations.

And then, they also separately looked at reducing load through adding lighter-weight materials and reducing drag and rolling resistance, as well as efficiency with -- with various successes, and we've utilized both elements right from their projections.

With respect to costs, they generally came up with their long-term projections, based on fully-learned, high-volume costs, but they came up with schedules that we didn't, at this point, alter for phasing those costs in.

They developed separate estimates for specific technologies that are of high interest

to this effort. They grouped internal combustion engines into a single category, but they came up with separate estimates for hybrids, plug-ins, battery-electrics, and fuel cell vehicles, and scaled the costs incrementally, based on sort of the electronics and sizing elements that I've summarized here that they've assumed for each of these technologies.

Other key assumptions that we generally concur with - they assume that its manufacturers are under a -- a period of at least another decade to further fuel efficiency improvements within the light-duty fleet that they were going to trade would have been an historical steady increases in performance and utility to be able to now take those increases and downsize engines to be able to more efficiently and cost-effectively comply with standards.

We've summarized some of the other elements here that are -- we're utilizing in our study, based on that work. I'll talk a little bit more about the battery costs in just a bit.

And, again, because there were -- there was a modeling package that we could get into and -- and make some changes to -- to fit with

the structure that -- that were supporting CEC's analysis, we were attracted to using this LAVE-Trans modeling package to develop our estimates of fuel economy and -- and vehicle prices going forward, and scaling our historical references where we had differences in our baseline versus those in the -- in the NAS report, based on those projections.

I jumped past the fact that the study didn't focus on any specific powertrain improvement and -- and detailed modeling of diesel engines, but we did apply the separate load reduction gains from their work to diesels going forward and use that to forecast additional improvements in fuel economy and price.

And one of the things that I planned to do this time that I highlighted at the bottom of this slide is we ended up initially setting in place battery costs that were scaled from one of their more aggressive scenarios - the mid-range scenario that are listed here.

And one of the things we will do and we'll have time for under this IEPR schedule is to test the model sensitivities to those battery cost assumptions.

Continuing quickly to try and get through the rest of these key elements, one of the things that we have to do with the output or the -- the elements of a LAVE-Trans modeling to be able to adapt it to California involves projections that we make with the attribute called the number of models that are available, which, again, are broken down by technology type and vehicle class.

And a key element that I wanted to -- to point out here is this is what we're doing to apply targeted penetrations of plug-ins, electrics, and fuel cells.

Initially, we're going to do that based on ARB's scenario two from their vision modeling that does, in 2025, hit that 1.5 million ZEV target, and then apply that to this model's attribute, based on proportions of sales that are tied to the vision forecast. So, we'll do that as a starting point.

Another enhancement that we're applying in these initial forecasts is some research that was done a couple years ago where a -- a broad, robust sample of dealer prices were analyzed to come up with effects of size-class shifts, you know, from larger, less fuel-efficient vehicles

to smaller vehicles as fuel prices change, and we'll incorporate that into this set of analyses.

Any quick questions on the light-duty fleet before I transition to heavy-duty?

(No response.)

MR. CARLSON: Okay. This will take a little bit less time.

The first thing I want to point out is, and I alluded to it earlier, the -- the data sources and tools that we're using use a different set of vehicle classes.

EMFAC 2014 has a scheme that encompasses thirty separate heavy-duty categories that are tied to both size and type or usage to align with state rules. CEC's mapped those to a smaller set of categories it's using in-- in its demand modeling, but, again, they're still tied to some degree to the GVW classes and usage.

And then, this market penetration model that we're collaborating to use collapses out further into three more aggregate categories that I've listed here.

All three models employ schemes to -- to break down estimates into the key fuel types that we're interested in, as I've listed at the

bottom.

COMMISSIONER SCOTT: I have a quick question there in terms of -- as you know, we're -- we're looking towards near zero and zero emission vehicles kind of across -- across the board. And so, will you look at fuel cell electric vehicles or batteries in this space?

MR. CARLSON: In the heavy-duty sector?

COMMISSIONER SCOTT: Yes.

MR. CARLSON: We will try. I mean, this is an area where I meant, right now, the available information is very sparse and, if we don't have anything in our initial forecasts, it's something we'll pursue as the IEPR effort moves towards fall.

COMMISSIONER SCOTT: Okay.

MR. CARLSON: The -- one of the stumbling blocks - but we've gotten past that - is identifying a -- a sufficient sample of vehicle historical price data, which, as I noted, is -- is something that's -- many of the content providers only focus on light-duty vehicles.

We just identified an entity called Price Digests and a database that they maintain called Truck Blue Book, and has purchase a -- an

extraction of their data that has what we were particularly interested in - new vehicle MSPR prices.

And these data that we purchased encompass the last ten most recent model years. The data are broken down as I've listed at the bottom here by -- by make, model, model year. There's information on -- on weight category, axle configuration, engine, and fuel type.

And that database has several thousand vehicles in that we were processing into input structures that I will talk about in a minute that will fit into this Trucks Market Penetration model.

The other key element that we're feeding into the model is fuel economy, and we're initially using the new EMFAC model to develop both our historical and forecasted future efforts.

And -- and the reason that we think it's a reasonable starting point, where we might not have used EMFAC in the past, is that we understand, even though there's limited documentation, that ARB has, in this release that was just published in the last few months,

they've -- they've set of EMFAC in a mode called default care, where they have basically reconciled its projections of fuel use and tied to VMT fuel economy to match the historical fuel sales we have in the state from the BOE records.

And I did notice that the -- the model outputs as we've processed them also incorporate forecasted fuel economy effects from CAFE regulations that have been adopted for the heavy-duty fleet that covered these model years 2014 to 2018.

And this slide shows a sort of a synopsis of how this NPC Trucks Market Penetration model is being used. We'll provide the -- the price and fuel economy inputs and work collaboratively with CEC staff.

And I think Bob McBride later will talk in a little bit more detail about that. But the data will fit into the model in the form of base technology prices - diesels would be a base technology for the larger-sized trucks, as an example.

And then, we have sufficient data from this Price Digests extraction to come up with current estimates of incremental costs for

gasoline.

We're going to supplement what's fairly limited natural gas data that we found existed in that database with information that staff has provided us from the CEC buy-back program, and then, as you had questioned me earlier about some of the other technology costs that we'll still be trying to dig information out and do some sensitivity runs within the model to see what those effects are.

I noted earlier that the fuel economy is being summarized into these three broad classes. And then, the last component that I had touched on earlier is, unlike what we're doing on the light-duty side, we have all sorts of explicit separate attributes.

This model works with one other thing called a preference factor that, with the assumption that, when technology prices are basically equal, what's the relative utility or value as a composite for one technology versus another. And it's those three primary elements that the model then uses to project penetrations of alternative technologies.

I'm just going to briefly close with the

fact that we're going to have these initial forecasts delivered around the end of the month, and we plan to collaborate with staff, and we'll have the time on this IEPR, to do much more extensive sensitivity analysis, including things where we're going to take our own estimates of sales, or stock as CEC talks about them in -- in demand-speak, and -- and track them between what we have tied to our attributes and -- and what comes out of their demand models, and -- and take time to do more examination of consistency with other forecast elements within the IEPR.

And the workflow is being set up, even though initially, in this first set of forecasts, we're only going out to a 2026 horizon, that we'll have the workflow and utilizing this NAS model and its longer-term scenarios - the ability to look into longer horizons, if of interest.

And that concludes my summary of -- of where we're at on vehicle attributes.

COMMISSIONER SCOTT: Great. Thank you very much. I asked all my questions as you went along. (Laughter.)

So, I think we are now to the lunch break portion of our agenda, and I see that it's --

it's 12:40. So, could everyone please come back at 1:40 and we will get going again at 1:40 sharp.

Thank you to all the presenters for your excellent presentations this morning.

Heather, do you have anything to add?

MS. RAITT: No. Thank you.

(The lunch recess was taken at 12:40 p.m.)

A F T E R N O O N S E S S I O N

1:43 p.m.

MR. RHYNE: All right, it looks like we have everyone back in the room. I think we're ready to get started again. So, welcome back from lunch. Again, my name is Ivin Rhyne. Welcome back to the Inputs and Assumptions for Transportation Energy Demand Forecast Workshop here at the California Energy Commission.

Since we broke for lunch and don't have a speaker ahead of this next speaker, I will go ahead and do the introduction. We have Marc Melaina from the National Renewable Energy Laboratory.

Marc works with our transportation -- transportation division under the AB 118 program and he's here to provide some additional information on vehicle attributes and alternative fuel station availability, so thanks, Marc.

MR. MELAINA: All right. Thank you for the introduction and for the invitation to speak. I am going to present an overview of vehicle attributes from two different studies, and then a little bit on -- various studies on station availability and consumer preferences, mostly for

light-duty vehicles.

And I just want to acknowledge my co-authors here, Yongling Sun and Aaron Brooker, who helped put these slides together.

So, just as an overview on vehicle attributes, I'm going to look at some of the fuel economy and cost trends from the Annual Energy Outlook recent reports and then from the NRC study, which we also heard about earlier, and comparison of those as a background, and then go into a few issues around consumer preferences and responses to those vehicle attributes - in particular, range limitations for limited-range vehicles, such as battery electric vehicles, and then availability of refueling/recharging stations for hydrogen, CNG, or electric vehicles.

So, you can see these are all oriented pretty well towards zero-emission vehicle market adoption. So, I'm trying to highlight those issues, and then I just have one slide on proposed future work to look at the role of policy in supporting market growth.

So, just to orient us a little bit on the vehicle attributes topic, I think it's important to remember our incumbent gas and diesel vehicles

are going to continue to be very competitive. They're going to improve over time and that -- that can't be disregarded when we look at alternative fuels and their market potential.

At the same time, there's a lot of technical background to support the -- the potential for alternative fuels and advanced vehicles to both gain in market share and provide very deep carbon reductions over the long term. And, if those are a little bit at odds, I think it's important to think about the role of innovation in response to policy itself.

And I think that the two studies here I'm going to highlight will make that point more clear. Or, the -- the first study doesn't look at strong policy drivers, and the second one does.

Then, on consumer preferences, there's a lot of uncertainty around this idea, but I'm going to show some data that we have on the penalty of limited range for vehicles -- for battery electric vehicles, and then a study that we did a few years back on station availability and the role it has on consumer decisions to purchase vehicles.

So, station availability -- all right. Station availability in terms of consumer responsiveness - so, this is an important barrier for purchasing battery electric vehicles, potentially. It's also a barrier for plug-in vehicles to achieve electric miles during operation if there is more public infrastructure available.

Station availability is critical for fuel cell vehicles, in terms of hydrogen stations being the only place they can refuel. And so, I want to try and shed some light on that, but then also show that there are great uncertainties around how consumers perceive that market barrier.

So, to start with vehicle attributes. So, quick overview of the light-duty vehicle - total sales on the left from the Annual Energy Outlook for 2014. You can see gasoline, as we saw earlier, dominates the sector.

If we take a small sliver off of the top there, and blow it up to the figure on the right, these are the percentages of market share by 2040 - so, we're starting in 2011 on the left, going all the way up to 2040 on the right side of

those graphs.

The orange is hybrid electric vehicles, only five percent of sales by 2040. This is our reference case scenario. Small sliver of about half a percent is electric vehicles. A little over one percent is plug-in electric vehicles. And then, fuel cells you can barely see here. And gaseous vehicles, as well - about half a percent. So, please appreciate the scale difference here, even out to 2040, in terms of very, very limited market share increase.

COMMISSIONER SCOTT: Marc, could you give us a little bit more information on some of the assumptions that go behind that? That's a very, very small number.

MR. MELAINA: Right. I think -- I think it'll become more clear when I start going into some more details. A lot of it --

COMMISSIONER SCOTT: Oh.

MR. MELAINA: A lot of it is cost, the up-front costs of the vehicles --

COMMISSIONER SCOTT: Mm-hmm.

MR. MELAINA: -- and a lack of strong policy drivers compared to, you know, the California market situation.

COMMISSIONER SCOTT: Right. And these are nationwide numbers.

MR. MELAINA: They are nationwide.

COMMISSIONER SCOTT: Yeah. Okay.

MR. MELAINA: That's right.

COMMISSIONER SCOTT: Great. Thank you.

MR. MELAINA: To -- to show some of the variations, AEO does have a few different side cases - besides the reference case, they have quite a few. Two of the interesting ones we pulled up just to show that the -- the results from the previous reference case don't change much.

And their high oil price case, this is just as alternative fuel vehicles, the percent within that category. In the reference case on the left, in the middle is the high oil price, where oil goes up to $200 a barrel by 2040, very little effect on the market at all for alternative fuel vehicles.

And then, for their greenhouse gas case, they do have one with a ten percent -- or, sorry, $10 per ton and a $25 dollar per ton. You can see, overall, if -- if you can make out the top graph, overall, they do get a greenhouse gas

reduction in the greenhouse gas $25 per ton case across the whole economy, but it's not from any change in the transportation sector and it has very little impact on light-duty vehicles in general.

So, those are two interesting policy -- or market scenarios that they've done, but the story for light-duty vehicles really doesn't change.

So, if you'd move now to the study that was mentioned before lunch, the 2013 National Academy's Light-Duty Vehicle Greenhouse Gas Emission study - the goal of this Committee was to look at an eighty percent reduction in light-duty vehicles by 2050.

And what's shown here is a market share situation very similar to AEO's, which they used as their reference case, which, again, essentially, is almost no change in the vehicle market share, this time out to 2050. The red sliver or wedge is hybrid electric vehicles, and the small orange one on top -- on top is plug-in hybrid electric vehicles.

So, that was their starting point, and then they explored various different scenarios

that did get to -- either to the eighty percent reduction or close to the eighty percent reduction. And they also looked at petroleum reduction as a metric.

So, these are three of the more in -- aggressive ones with electric drive. Now, we see some wedges standing out, out to 2050. For light-duty vehicles, we see the top purple wedge here is battery electric vehicle sales -- total sales, and then hybrid electric vehicles is red, and for -- for their assumptions, plug-in hybrid electrics only have a very modest market share.

But, you can see this is much different than the previous reference case. And this was called the Plug-In Electric Vehicle Emphasis Scenario. There's also Fuel Cell Electric Vehicle Emphasis, where the green wedge is the hydrogen fuel cell vehicles, and then they had a mixed scenario with plug-ins, fuel cell, and also advanced biofuels.

This is a little bit busy of a figure. This is straight from the National Academy's report. But, what this is showing is their various different scenarios. I just showed these three that are highlighted on the bottom, and

this is showing the greenhouse gas reduction in 2050 compared to the -- the reference case, and what it is is the blue bars are the vehicle -- mostly the vehicle technology adoption efficiency, and then the difference between the blue bars and the red is decarbonizing the fuel that goes into those vehicles.

So, for the plug-in electric vehicles, you get a lot of efficiency improvements, and then, for the low-carbon grid, you get some additional greenhouse gas reductions. Same on hydrogen where this blue bar would primarily be hydrogen from natural gas, but, if you introduce renewable hydrogen, this is one of the cases where they did get to that eighty percent reduction goal by 2050.

And then, for the combined case, where they threw everything into the scenario, they decarbonized the grid plug-in electrics, fuel cell vehicles, and biofuels. That's their -- I believe that was their deepest carbon reduction by 2050.

So, very different types of studies. So, just to highlight some of the differences, AEO's official government forecast, very objective

analysis, a national-scale projection. NRC Committee was a -- a one-time study from a committee with an explicit goal to look at the eighty percent greenhouse gas reduction. That was from the -- that's the name of the committee. That was their -- how they started out was to try and understand that goal better. So, they -- they come from very different places in terms of why they're doing analysis, including their methods.

AEO, of course, is a long-standing institution, where the -- the National Research Council gathers people together for particular studies. In a policy context, AEO is primarily interested in existing policies, where NRC was actually asked to evaluate what policies would bring them to their goal, so they knew that that was -- the policies themselves were part of what they were exploring.

On technology trends, AEO is very much market-oriented and market viability, competitive actors within their -- their simulations, where NRC knew pretty well what their technological trends would have to be to get to eighty percent, so they took time to look at very aggressive

performance cost improvements.

But then, after they evaluated how close they get -- could get to that goal, then they sort of back-calculated, I would say, the policies that got them there. It's maybe a little bit of a simplification, but, again, a different approach than AEO.

I think it was mentioned earlier that the -- the NRC study used mid-train -- mid-range and optimistic assumptions for technology trends, but, really, they were both fairly optimistic. Just to make that point a little clearer, here's mid-sized car fuel economies from AEO.

So, this is miles per gallon on the left from zero to two hundred miles per gallon - for battery electrics on top, and then plug-in hybrids, conventional vehicles, and then there are fuel cell vehicles here, the purple line, just under sixty miles per gallon.

And then, for another category, compact cars, you see similar trends. And what this is is an increase, basically, to meet CAFE and then a plateau in -- in vehicle performance after meeting CAFE.

If we go to -- so, this is just for cars.

If we go to the NRC reference case, their reference case is very similar. They have slightly more efficient vehicles here, but they're also assuming you meet CAFE and then they plateau in their reference case. So, similar to AEO, but their -- their fuel economies are higher, especially for the battery electrics and fuel cell vehicles, and I'll explain why in a second.

What happens then, when NRC explores their eighty percent reductions, is they do not plateau at CAFE. Their technological improvements continue all the way through, and that's a big reason why they're able to get to their eighty percent greenhouse gas reduction.

I guess one more point here is the -- the discrepancy here with battery electrics - this is about a hundred and eighty miles per gallon, and here's a hundred and forty for the compact cars, say a hundred and thirty for the mid-sized cars, for BEVs.

The fuel cell vehicles are down here, and this is partly because there's no -- no deployment -- significant deployment of fuel cell vehicles at all in AEO, so there's no technical

increase or improvement, where, in this case, they're -- they're assuming that the technology does mature to meet CAFE.

So, that's a lot of different combinations of scenarios here, but, if we look at AEO, this is their mid-sized car prices. The dotted line is our -- our conventional, average new mid-size car, primarily gasoline, and then all of the other ones are slightly more expensive, so, you know, positive incremental costs on top of that, slow declines out to 2040. But still, by 2040, this is a ten, fifteen thousand dollar difference here across this range of -- of vehicle types.

In the NRC studies, we see a much different dynamic. In their reference case, they also have slow declines in vehicle costs. So, the green here is battery electric vehicles, hundred mile range.

The solid line is their mid-range, and the dashed line is their optimistic. So, it's the green -- the purple is the fuel cell electric vehicles, and, in this case, they see rapid cost reductions in -- in plug-in hybrid electric vehicles in the near term.

If people are wondering about these years, you have to remember the study came out in 2013, so the analysis was probably 2012. And so, if they updated it now, this -- this would be a different slope.

But, deviating from the reference case to start looking at one of their deep carbon reduction cases, these cost curves change dramatically, and that is basically because of their assumptions of policy market drivers that are in place to accelerate adoption.

And these platforms come down the learning curve much more quickly. Their fuel economy improves, and they become cheaper, due to economies of scale and successful market deployment.

So, a dramatic shift from this green line for the BEV 100s down here, where now this is the -- sort of the learning costs have been paid and market adoption happens much more quickly. AEO is maybe a little bit in between these, but you can't -- you don't see a dynamic like this between the cases in AEO. There's no -- no significant shift like that in the way they set up their -- the future scenarios.

So, to -- to look at that a little bit more, the way that this was done - analytically, within the National Academy study - is they assumed a certain type of multiplier for vehicles that are deployed at small volume. And so, those cost multipliers is what keeps these vehicles higher up on this cost range. As the number of vehicles sold increases over time, those multipliers are -- are reduced and you get these drops down to a competitive range with conventional vehicles.

But, a lot of that progress is because the policies are reducing price through subsidies, primarily, to get cons -- to make those vehicles attractive enough that people actually adopt them. So, they do have a -- a Vehicle Choice model, (indiscernible) model that determines the degree of subsidy required to get these cost reductions to occur over time.

I guess the general statement here is that the volume of the subsidies required to achieve market success is one of the results of the study. That's what they're actually trying to estimate is if we -- if we believe these cost multipliers, how much would you actually have to

support this system, for how long, at what magnitude to get market success?

Underlying those multipliers are detailed analyses of the -- sort of the baseline costs of the different drive trains. So, here, we have car costs in the mid-range, car costs in the optimistic -- this is before those multipliers are applied for limited volume production.

So, you can see the difference here for battery electrics is about sixteen thousand over an ICE. For fuel cell vehicles, it's eight thousand over. And then, the multipliers could double those in the early years, in terms of the amount of support the market needs to get market success.

Once you get out here to 2030 and you have paid those -- you have those policies in place and they've become effective, in the optimistic case, you start seeing, you know, viable competition between the different makes and models, and that's when you see the strong shift in market. Mid-range, not so much - there's still some cost differential there, so that was an interesting differential they had between the mid-range and optimistic in terms of

sensitivity.

So, just highlighting, here, key parts of these learning curves, the effectiveness of the market support policies, and then my next topic is the -- the way in which you have to address consumer preferences for these different types of vehicles.

So, here's an example of something that was mentioned earlier about understanding what's happening in the market today in order to recalibrate modeling of things into the future. So, this is a result from NREL's ADOPT model, looking at actual vehicle sales, we use Polk data for registered vehicles, and we look at the -- all the different consumer and vehicle attributes in our Consumer Preference model to see the different influences.

This graph here shows the change in the perceived value in the vehicle for a few different attributes. So, this is the MSRP equivalent value. The green here is the MSRP itself, so it's changing from zero to sixty thousand, and you see this -- the linear -- meaning that's sort of the baseline. If you increase it thirty thousand, it looks like it

costs thirty thousand more. If you decrease it thirty thousand, it looks thirty thousand less expensive.

What about acceleration? If you change acceleration, here, in terms of seconds - zero to sixty miles per hour - from 3.9, very fast, to 12, you can also talk about an equivalent value -- perceived value of that vehicle. A very fast acceleration is valued to a high degree of, say, twenty thousand, in terms of certain consumers valuing that vehicle. If it's a slower vehicle, then it's less valuable to people and so you go into this negative range, so it looks twenty thousand less valuable to you as a consumer than the equivalent vehicle that had an average acceleration.

Just want to check to see if people nod their heads if that kind of makes sense. Okay. So, this -- you can -- you can talk about any vehicle attribute this way and translate it to that MSRP baseline to talk about it in terms of perceived value on the lot when you're evaluating one car compared to another.

So, what we've done is tried to pull up some empirical data on range -- limited range for

battery electrics and, in particular, LEAF sales, where we had enough data to run the statistics and feel like we had a pretty good handle on what the influence might be of range among all the other vehicle attributes.

There's not a lot of certainty around this, because we don't have enough data to be as certain as we are about the other attributes, but when we run -- run this blue curve, a lot of range, the vehicle doesn't look a lot more valuable to people, so they won't necessarily pay a lot more for another hundred-mile range, say, from three hundred to four hundred.

But, once you start going below into the lower ranges, it appears that there's about a ten thousand dollar penalty against that vehicle to get down to the sixty-two mile all-electric range.

So, when we run it with that curve, we get a pretty good match to actual LEAF sales after we've tried to account for all of the other possible influences on consumer choice. So, this is -- is definitely not what we feel like is the -- the definitive answer on the value of range to consumers, but at least we have found

some recent empirical data from LEAF sales, that we can say we -- we know roughly what the range might be. As we get more market data on battery electric vehicles, we'll be able to make better estimates of the value of range.

I guess just to clarify here, the way the ADOPT model works is we have different curves for different income levels. So, the solid curve is for a higher-income household. The dashed curve -- I'm sorry, it's for the lower -- the dashed curve is for a higher-income household, so you can see higher-income households are willing to pay more for a higher acceleration than a lower-income household, for example. That's why we have two different curves for each attribute.

Okay. So, range is challenging. Then, to make things more complicated, we can start talking about limited range and limited refueling/recharging availability and the combination of those. And this -- this is partly where I end my recommendations is how to tackle those -- those modeling issues.

This is a study we did a few years back. We have a paper at the bottom that walks through the main conclusions. It was an in-house

consumer choice survey where a panel of people, maintained by a -- a marketing company - they have computers in their homes and they agree to take a survey, you know, a -- a message comes up in their house, they go to the computer that the company has provided to them, and they agree to take a survey.

In this Discreet Choice model, there's two different options. There's a -- on the left side of this panel, it goes through all the attributes of the last vehicle they purchased. We only allowed people to take the survey if they'd purchased a vehicle in the last two or three years.

And then, on the right, we have a comparable vehicle with a lot of the similar attributes, but we showed them maps of where they would be able to refuel that vehicle compared to a conventional vehicle.

We didn't name the fuel type; we were trying to zero in on the value of -- or penalty of limited range for these three different scales of -- of refueling availability.

So, the way the survey works is we ask that -- that question ten times in sequence.

Each time, the algorithm changes the levels for these different attributes to learn from their previous response.

So, the algorithm tries to -- to zone in on how much they value each vehicle attribute. We had about five hundred surveys in major cities across the country, and we actually deployed this survey three times, each time improving on the design of the survey to get better results. So, the last time we did it, we felt like we had the best results.

So, there were three different scales at which we showed the availability of stations. So, I -- I've -- have a typo here, but this -- the top title should be Seattle for local coverage. So, this is -- instead of Seattle, if people are from Los Angeles, they'll know this is not Los Angeles.

So, here's conventional vehicles on the left. You -- you purchased a car within the last three years. These are all the stations where you can refuel that car. We showed them something equivalent on the right, and this is the mid-range, a fair -- a fair number of stations around, but not quite as ubiquitous as

gasoline. That is one of the attributes of this vehicle.

And then, they choose which one they're going to purchase, and they compare this with all the other attributes here, including vehicle price, and then they click one or the other - which one are they going to buy?

So, this is one of the reasons why we had to do the survey a couple of times is to make sure these maps were actually capturing a statistical response that was meaningful and was consistent.

That -- we had to improve upon these maps and make sure people could interpret them correctly. So, we did that for this local, metropolitan scale of availability, and then we went out a hundred and fifty miles - again, this is Seattle, not Los Angeles.

A hundred and fifty miles around their urban area, so this would be for fairly long-distance trips. And we showed them -- you know, gasoline is everywhere for your gasoline vehicle. For your alternative-fuel vehicle, these are where the stations are. If that's not sufficient, you know, the algorithm could

identify how much of a penalty this would be for limited availability. And then, the third scale was along interstates, so we say, here, you can drive anywhere with a gasoline vehicle. With your alternative-fuel vehicle, you can only go this far.

The way the algorithm works between those ten choices is we had three different versions of this map. The first versions said the interstates were only right around Seattle. This is the mid-range one. And then, the third one had coverage all across the country, so you could drive everywhere.

So, because we had those different levels, we could try and discern how much people value each of those in a statistical way. And, again, this is partly why we had to tune the survey several times is to make sure we're getting meaningful responses to those metrics.

COMMISSIONER SCOTT: Marc, when you tuned those surveys, is -- is one of the things that -- when I was looking at the -- I think it was the third example -- no, maybe the second one, where it's -- it's -- I think it was one slide back on -- here, it -- and the -- how do you kind of

tease out sort of the range anxiety from the -- oh, if I -- or -- from -- I don't know where these stations are, right, so -- so, with a -- with a gasoline station, you don't really have to worry about it, because you just kind of know, every time you get off a highway or anywhere, it's just there.

MR. MELAINA: Right.

COMMISSIONER SCOTT: Whereas this, it might be within your range, but you don't know -- if you don't know on the map kind of where it is or where you're going, how did you kind of tease that out? Was that within the iterations?

MR. MELAINA: It -- it was. So, an example here is -- this, again, is the mid-range, a fairly -- fairly large number of stations around. In one of the first iterations, we had the lower-range and the mid-range were too similar, and so people -- their responses to those two -- they weren't statistically relevant, so people were not interpret them -- interpreting them as being distinct levels. So, we kind of knew that people didn't understand the difference between that level of coverage.

So, then, we increased the number of red

dots on this one and lowered the number on the previous one. So, the previous level below this, you would have, I want to say, maybe one-eighth as many stations. And so, they could really see it was different.

Another thing we did to try and improve it, especially on this local one --

COMMISSIONER SCOTT: Mm-hmm.

MR. MELAINA: -- is we said -- one of the questions -- before they got to this series here, there are some preparatory questions to kind of gauge their understanding and things and get more information about them. As we asked them, we showed them the -- this map and said, can you find where you live on this map?

COMMISSIONER SCOTT: Got it.

MR. MELAINA: Can you see the red dots closest to your homes?

COMMISSIONER SCOTT: Mm-hmm.

MR. MELAINA: So, they -- so, they -- if they said no, then we thought, well, we're not going to, you know, put a lot of weight on their response because this map is not working for them.

COMMISSIONER SCOTT: Right.

MR. MELAINA: So, those were a couple ways we tried to make sure they were working.

COMMISSIONER SCOTT: Got it. Thank you.

MR. MELAINA: So, here -- here are the results we got from those -- the last survey in four major urban areas. For that local level of coverage, we had - again, this is an MSRP-equivalent penalty against the purchase price of the vehicle - if the station coverage is about one to ten percent of existing gasoline stations, for the one percent, there'd be a four thousand dollar penalty against the purchase price of the vehicle.

Everything else considered equal is the way the -- the model works. And the -- for the ten percent, there's about a seven hundred and fifty dollar penalty against the purchase price of the vehicle.

At -- that's one geographic scale. For the regional map, which we're just looking at, if we had about five to a hundred stations within that hundred-mile radius, the penalty range is three thousand, fifteen hundred against the purchase price of the vehicle. And we considered these -- we debated this, but we considered these

to be cumulative, so they would add on top of each other.

And then, for the interstate one, which I personally found really surprising, nine thousand to two thousand penalty against the purchase price of the vehicle if you were not able to drive along these interstates on very long-distance trips. Surprising, because we know people don't make trips like that very often, but, when they look at a car to buy it, if you can't do that, there's a really high penalty with that vehicle.

So, to contrast this, and I think people have seen, at these meetings, similar studies, there's another way to think about this. This is stated preference results. This is people reading a survey and saying, well, this is what I would do, theoretically.

If you try and estimate, say, the travel time to go to another station - say it takes you another five minutes to go drive -- drive of your way, it costs you twenty, thirty dollars an hour to drive that distance, you come up with much lower penalties for the local driving time. I don't think you can do that with the regional

interstate, but I think UC Davis, UC Irvine have come up with these types of numbers to say this is what we think the penalty is for these different ranges.

So, to contrast that graphically, this is the penalty on the Y-axis and this is the metric of the number of existing stations on the horizontal axis. These curves here were our point results for the different cities, so here, you see that two to three thousand dollar penalty range for very few stations.

The Rational Actor model is much less than that. So, I think, here, I say it's about three time -- three to four times less than these stated preference ones. So, this is simulating how much it would actually cost people, in terms of a nuisance, to drive to another station.

Where these are estimating people's perceived value of station availability, a big difference between here -- in our paper, we -- we propose that this range is sort of the uncertainty around how you might account for this cost penalty in a -- a Market Simulation model. And, at least, you have some numbers you can -- you can put in for the rest of your model.

Okay. Just a couple more slides, here. What -- what can we do with these ideas to help the Energy Commission and understand the market as it develops over time? As new data become available, we can improve upon these types of models by giving better statistical correlations, like the one I showed with the LEAF sales and limited range. The example here I have is to try and understand new -- using new vehicle registration data, how the existing network of -- of charging stations, here this is fast chargers, how that might be influencing market adoption over time.

So, we tried to do this last year. We could not find statistical correlations that were strong enough. We're going to try and do this again this year with our new set of vehicle sales data and new charging stations that have been deployed, to see if, spatially, we can -- we can tease out what that effect might be, isolating it from all these other factors for both vehicle attributes and consumer attributes.

So, just -- if people are familiar with the statewide assessment that we did with Leslie Baroody, this is the heat map of early adopters,

and then DC Fast Chargers overlaid on top of that.

So, this is my last slide on future work for consumer preferences. The -- the first one here is what I just reviewed is market trends associated with the responsiveness of consumers to EVSE infrastructure. I think that will improve over time. It's just a matter of how -- how better the statistics get over time as we get new data and we can recalibrate our models accordingly.

Another alternative is improved survey methods, building upon past work to try and understand -- understand the role of station availability as one of the factors within Consumers' Choice modeling.

On policy support mechanisms, I think it's been shown that it is possible to include explicit refueling station metrics in simulations of markets to try and improve projections. So, I think the National Academy's did that, we've done some of that, other people have done that, as well.

So, I think that's an analytically tractable problem to do that. And I think this

gets back to an earlier comment about the geographic scale of how -- how much geographic disaggregation do the different models have.

And then, the hardest one is the last bullet - interactions or trade-offs between, say, limited range and station availability. There have been some studies out like that to try and tackle that, but I don't think I have enough empirical data to really understand it. But, at some point, especially for organizations like the Energy Commission, understanding the support mechanisms needed for the market, we have to try and tease that out.

All right. Thank you very much. Are there any questions?

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

(Laughter.)

COMMISSIONER McALLISTER: Yeah, I guess I want to just see -- maybe get your ideas at a high level on sort of analogies. I really appreciate your being here and have worked with NREL in -- in a number of capacities over a long time, internationally and in this country, and I really have a lot of respect for the work you

guys do. And, certainly, I'm very glad you're here as a resource for us.

So, in -- in California, we had a -- a ten-year program or so for solar, and I think, had I of -- it's -- it has been a big success. You know, different folks have different -- different sort of feelings of the relative influence of different policies on that success. But, basically, we've seen a market transformation for solar and a lot of that has to do with costs coming down heavily. And, you know, whether we'll see that in this realm, TBD.

But, I guess, you know -- and we saw the -- the Annual Energy Outlook, you know, very low, long-term projections of -- of adoption and -- and, you know, penetration of these technologies.

We're all certainly hopeful that it'll look more like the National Academy and -- and less like the -- the Energy Outlook. And we're actually counting on it, here, because we have policy goals that we really need that to happen in order to meet.

So, I guess -- yeah, the -- the -- at some point, there -- there's sort of a tipping

point, where you get the right policies in place, the right technology in place, you know, you're pushing them along with subsidies and other policy supports, but people start to get it.

And then, they adopt, and then, over time, then your problem is a good problem to have - it's when you wean the marketplace from the subsidies, right? Because it no longer needs them.

Anyway, I guess, maybe at a high level, you know, you've -- you've touched on many of the factors here, like where the stations are, you know, those are both combinations of subsidies and markets, but sort of -- do you have a -- sort of a qualitative sense of what's -- of what consumer choice -- you know, what niche, say, EVs or -- or these alternative -- what -- what's missing right now?

Is it just, basically, they're too expensive and there aren't enough? Or, like, what's it going to take for this to be something people bring into their homes?

MR. MELAINA: Okay. So, I -- I thought I could answer --

COMMISSIONER McALLISTER: It's a high-

level question, I'm sorry. But --

MR. MELAINA: It's okay.

COMMISSIONER McALLISTER: I'm trying to do some visioning here. It's like, what -- you know, what -- what are -- what are the -- what's the set of conditions we're trying to create? What's that going to look like?

MR. MELAINA: Okay. So, that's a good question and I thought I was ready to answer until your last part of the question.

(Laughter.)

MR. MELAINA: So, let me -- let me go back a little bit and -- just show these -- these curves again in reference to the solar program.

I think this is -- this analytic problem that the Academy -- committee did with learning costs, to get these vehicles down the learning curve, is a direct analogy to the solar program. And I think it was actually discussed, you know -- if it's not in the reports, there's sort of an explicit recognition that that's what they were trying to show is you put a policy in place, support these, bring things down the learning curve, and that they did estimate -- I don't have it here, but in the report they estimate how much

that would actually cost for these different cases to get yourself to the market success that solar has seen.

If I can try and rephrase the question a little bit, I think --

COMMISSIONER McALLISTER: Please.

(Laughter.)

MR. MELAINA: The -- the niche market, in this case, is the California market, is the place where the success can happen. But now, instead of doing this learning for the whole country, there has to be a spillover effect between the success in California with the rest of the market to get things to accelerate. If that spillover is not very effective, California is going to work for a long time and not move these curves very far.

So, if, on the other hand that California is able to move these curves, then there is a huge windfall benefit as the rest of the country catches up and California can take indirect credit for that, because they --

COMMISSIONER McALLISTER: Right.

MR. MELAINA: -- they moved the technology, but I think the -- the harder part of

that is what you asked, is what -- how do you -- how do you sort of tune the policies in California to find the most effective ways to do that? I -- I'm not going to try and venture an answer to that.

COMMISSIONER McALLISTER: Well, I -- although I -- you -- what -- what you just said is actually extremely helpful, because, in solar, there were a lot of exogenous influences that may -- you know, I mean, if we claim credit for lowering, you know, the -- the cost per watt for solar, it demonstrates quite a bit of hubris on our part, because we had Germany and we had other countries really pushing the global marketplace, and we don't really have that, at least to the same extent, in this realm.

So, I -- I -- the having -- having to actually have California uniquely double the marketplace every so often to get that learning, it -- it is -- it is a little bit daunting to think about. So, I think maybe we should be building coalitions and new -- in other marketplaces to sort of grow it overall.

MR. MELAINA: It's -- let me --

COMMISSIONER McALLISTER: I --

MR. MELAINA: Let me just add that there was a -- a study around the same time by David Green, University of Tennessee, for ICCT, looking specifically at California markets.

And I think he did some of the spillover California success, and I think -- if it wasn't that report, it was another one where he tried to take into account international factors, as well, in terms of learning, since the auto industry is a global industry, to bring down these learning curves. So, there have been attempts to try and combine all of those together into an analytic framework.

COMMISSIONER SCOTT: It -- he actually came and presented that to us last year when we were on the transportation focus.

The other -- the other thing, just to your point, though, is California is working with other states, right? We've got that eight-state MOU where we're looking to get 3.3 million zero-emission vehicles together on the road by 2025, I think. And we're working with other countries, as well, on the -- on the same thing, so, in -- in -- in order to kind of help accelerate that spillover effect.

MR. MELAINA: Yeah.

COMMISSIONER McALLISTER: Great. The -- this is a great upside to having joint workshops.

(Laughter.)

COMMISSIONER McALLISTER: I learn a lot, even more when you're next to me. Great. Thanks. Thanks very much. I don't know if anybody else has questions.

MS. BAHREINIAN: Good afternoon. My name is Aniss Bahreinian and I'm going to talk about the California Vehicle Survey. The survey is specifically focused on light-duty vehicles and we talked about some of the elements of it in the morning.

The purpose of this presentation is multiple. One, we want to provide information on an important source of primary data. Second, we want to talk about the elements of survey data that is used in formulating the Light-Duty Vehicle Choice model.

And then, we want to talk about why it is important to repeat these surveys and provide information about upcoming survey, which has already been posted and, obviously, we like to seek stakeholders' input on the new survey that

we are going to conduct.

One of the things that I can say, since there is no specific bullet on the collaboration, and they wanted me to talk about that, is that the 2011-2013 survey that we did conduct was actually extensively -- it was -- included extensive collaboration with Caltrans, and we drew our sample from the sample of travel survey participants for Caltrans.

The 2011 start of the survey was actually the culmination of the collaboration between CC and Caltrans, starting in 2008. So, it takes a while to get things done.

We started talking with Caltrans in 2008, and it led to the survey coordination and collaboration in 2011. And ARB joined our forces, and, in 2012 and 2013, ARB had a significant role in the survey design.

And we worked together on the vehicle attributes that we used for survey, which is very different from the vehicle attributes that Tom is presenting to us. These are projections; those were vehicle attributes that we designed for the survey.

And there were a number of important

changes that were made as a result of this collaboration that in -- we incorporated and was reflected, actually, in the survey instruments.

So, what is so important about the light-duty vehicles? As Gene Strecker's presentation showed, about eighty-five percent of the vehicles are in the household, and a very significant percentage of total vehicles in California are actually light-duty vehicles.

These vehicles are the focus of CAFE, ZEV, and other regulations and standards, and, obviously, they are very important to California. But, also, this market -- and I think that, in a large part, also, due to the progressive policies that the state of California has adopted, it has encouraged innovation in this field more than anything else.

As a result, you see the most dynamic markets and technology in light-duty vehicles. It's astonishing. Even yesterday, I was reading something about the blue cars in Paris, where they are -- where they are introducing this car-sharing program with about seventy thousand members and the idea was to solicit these people so that they could pay something like twenty

cents a mile for using these EVs. And the idea was to introduce them to the EVs.

The blue cars that they are adopting in France, they call it the -- well, the article was calling it anti-Tesla, because it wasn't anything fancy, it wasn't luxury. Tesla is very good, of course, as you all know, but the blue cars were very simple cars and they just wanted to introduce the idea of EVs and reach a very broad market. So, there you go. That's another idea, if anybody wants to advance this field.

It is also important that shifting economic conditions and prices lead to changes in vehicle choice. Consumer knowledge about this new technology -- and UC Davis has done a lot of work on consumer awareness of these new technologies.

All of these are going to change consumer preferences over time, as people are get -- getting more and more exposed to these vehicles, their preferences are going to shift and change over time.

So, the vehicle survey is really our tool to assess these changes. So, we periodically conduct these surveys in order to make an

assessment of the shifts in the market and shifts in the consumer preferences.

Light-Duty Vehicle Demand models, we should notice that our -- I mean, we talk about all these different surveys, and there are many different surveys. Our survey -- each survey has its own purpose, and our survey is specifically designed to match our models.

It is designed around the model, the end result of the survey is a model, and, therefore, from the very beginning, we design a survey in order to duplicate the current model and then create options for future models that are incorporating more and more options.

So, in the vehicle choice -- the vehicle type choice equation assesses the consumer preferences for different vehicles and fuel types. These vehicles are defined in terms of their attributes.

Marc was talking about price and range. Price and range are only two of the attributes of the vehicles. There are other attributes that we do incorporate in our survey that may not be incorporated in other surveys.

Data from stated preferences surveys of

household and commercial fleet owners are used to estimate vehicle type choice equation in each market. So, we have one model for commercial and one model for residential with different results. Energy Commission models uniquely differentiate between these two models; therefore, we conduct two different surveys and build two different models.

And, of course, we continue our collaboration with ARB and Caltrans in the new survey, whether it is in design and testing or other aspects of this.

The vehicle technologies that are in the survey -- you should look at this list. We have gasoline, hybrid, flex-fuel vehicles, diesel, diesel hybrid, CNG, et cetera. If you notice the blue line ones are the ones that we added to the 2011-2013 surveys.

The black ones were the ones that were used in the 2009 survey. And the red one that you see here is the new technology that we are going to add to the new survey that we are planning to conduct.

Self-driving vehicles have become important in the field, and so we are planning to

also add that to the list of fuel and vehicle technologies that we are going to incorporate into our stated preferences surveys.

So, I have added this slide. I know I -- I'm sorry that it may not be read very well, but there is no other way to talk about it - just to show it. If you notice, here, Marc was talking about range and price. If you notice in the first column, we have about twelve different types of vehicle attributes.

So, we define our vehicles in terms of these twelve different attributes. We think it is important for people to know what is the age of the vehicle. We think it is important for them to know the purchase price, of course - purchase price consistently and persistently, throughout the years, has been the most important variable in our surveys and models.

The trunk space is important for consumers. The incentives have their own space, so we don't include incentives in the price. We propose it as a separate entity, because we want to know how the consumers are responding to these incentives, and we have multiple incentives, like HOV lane, park -- free parking, tax credit, and

rebate.

Fuel economy, of course, is important to consumers, and what we have done right next to it, we are also putting fuel cost per mile, so that consumers can actually relate to this.

In the focus group sessions that we did conduct in 2012, we asked our focus group participants -- we said, okay, how could you understand a question on fuel station availability? Would the distance work for you?

And almost the unanimous response from the consumers was that we want to know how long it is going to take us to get to the fuel station. In other words, it's the question of refueling or fuel -- time to get to the refueling station.

This is what Marc was calling in their survey as the rational consumers. So, our consumers are actually rational. They want to know how long it would take to get to the fuel station. Is it five minutes, ten minutes, fifteen minutes, or what?

And so, what we did, we put the element of time in our access to the fuel station. We also have range, of course, and maintenance cost

is another factor, as you know - for some of the vehicles, maintenance cost is much lower than what it is for internal combustion engines. Acceleration, which is a measure of the power, is an important one.

And so, we give them all of these different vehicle attributes, not for one vehicle, but for four vehicles on each stated preferences choice instrument, and then we ask them all, choose one. Which one are you going to choose?

And, prior to designing this, we asked them, what is -- what is the kind of vehicle that you're planning to buy next? And they tell us. We use that information to design the type of vehicles that go here, and one of our findings, actually, in 2013 was that, if -- if they told you that they want a van, for instance, after we examine the pretest data, it was very unlikely for them to change it in any other direction.

So, then, we revised our survey to make sure that we are offering the vehicles that are in the close vicinity of the vehicle that they have said, in terms of class -- the vehicle class, size, et cetera, it is close to the

vehicle that they have said they would purchase.

And then, we also -- another change that we made was that, in 2009, we were offering the range values only for CNG and EV vehicles. In 2012-2013, we took the approach that we are not going to have any blank cells.

In other words, we give the information for every single vehicle that you see on this sheet. And then, we repeated this about eight times and then used the results to estimate the model.

Another feature that --

COMMISSIONER SCOTT: Can I ask you just a quick --

MS. BAHREINIAN: Yes.

COMMISSIONER SCOTT: -- question --

MS. BAHREINIAN: Sure.

COMMISSIONER SCOTT: -- back on that slide --

MS. BAHREINIAN: Sure.

COMMISSIONER SCOTT: -- a -- a couple questions. So, for the -- for the fuel cost, are you using kind of like the fuel costs that day? Are you taking kind of an average fuel cost from the year before? Or -- or -- where -- where are

you getting the -- you know, the -- the fuel cost per mile? What -- how are you calculating that?

MS. BAHREINIAN: We have -- we have a set of prices and we offer them different prices, because --

COMMISSIONER SCOTT: Uh-huh.

MS. BAHREINIAN: -- our objective is to actually measure their sensitivity to the price, not -- we -- we try to make it close to what it is around the survey time, but our main intention is to see, if we vary this price by this much or that much, how would they respond? So, it is their response to that variation, not the level --

COMMISSIONER SCOTT: Not the actual cost.

MS. BAHREINIAN: -- of the price.

COMMISSIONER SCOTT: I see. Okay.

MS. BAHREINIAN: And then, we use the MPG in order to -- MPG of those same vehicles - we use those in order to measure the fuel cost for them. So, the two correlate with each other.

COMMISSIONER SCOTT: Okay.

MS. BAHREINIAN: I should also add that, when it comes to the household, we survey households of different types. And, if you can

see -- oh, before I move that, since I have this slide here, notice what we have here.

If you look at the incentive, the incentive is actually our policy variable. So, if we want to change the incentive, we can. We can specifically change the incentive and see what is going to be the impact on consumers' decision?

Another policy variable is the time to a refueling location. That's also a policy variable. So, we measure the consumers' response to this so that, if we want to use this in policy analysis, then we can do that.

COMMISSIONER McALLISTER: So, Aniss, did --

MS. BAHREINIAN: Yes?

COMMISSIONER McALLISTER: Did -- let's see. So, there is data where we have had incentive programs out there and we have been giving incentives to alternative fuel vehicles, and -- and we have some customer surveys that have been done on those participants. Are you using that information to figure out what that -- essentially, that, like, elasticity is? Like, how much, you know, bang do you get for your --

your incentive buck?

MS. BAHREINIAN: We have not used that in -- in the model, because, if you look at this particular instrument, what it does, it allows the consumer to trade off between all these different factors.

COMMISSIONER McALLISTER: Mm-hmm.

MS. BAHREINIAN: If we use something from outside, it doesn't allow us to trade off between them. But, when a consumer sees all of these side by side, right next to each other, they are doing the trade-off. And our model then accounts for those trade-offs. But, if we use outside, then I'm not sure, but we haven't looked at it. We can certainly take a look at it.

COMMISSIONER McALLISTER: Well, I -- I guess I -- I -- really, it -- it seems like it would be the fact -- you know, you could generate a factor or something --

MS. BAHREINIAN: Yes.

COMMISSIONER McALLISTER: -- based on that real world --

MS. BAHREINIAN: Yes.

COMMISSIONER McALLISTER: -- and then incorporate --

MS. BAHREINIAN: Yes.

COMMISSIONER McALLISTER: -- that in so that every --

MS. BAHREINIAN: Absolutely.

COMMISSIONER McALLISTER: -- for every thousand dollars of subsidy, you get some impact that's based in -- in some reality outside --

MS. BAHREINIAN: Absolutely --

COMMISSIONER McALLISTER: -- not --

MS. BAHREINIAN: -- we can --

COMMISSIONER McALLISTER: -- not the --

MS. BAHREINIAN: -- make adjustments --

COMMISSIONER McALLISTER: Yeah.

MS. BAHREINIAN: -- to that. Yes.

COMMISSIONER McALLISTER: So -- so, yeah. That -- I think that would be very helpful.

COMMISSIONER SCOTT: So, one other question.

MS. BAHREINIAN: Yes.

COMMISSIONER SCOTT: Within -- within a survey -- so, you're saying -- I -- I'm just trying to figure out, because there's so many variables that are different, how the model sort of sorts out. Why the -- which variable it was that influenced the person to make the choice

that they made?

MS. BAHREINIAN: It is -- it is -- it is the feature of the econometric models. When you run those, when they are making -- when they are estimating one-parameter values, the way they work, they keep everything else constant, and that's how they are teasing things out from each other, which is why we are doing this in a systematic way, actually.

And then, the other specific of our -- our -- of our Vehicle Choice models is that we have a large number of households of different types. So, if you notice -- if you look at this graph, you could see households that are at different income levels.

We have households that are -- have different sizes. So, every household type has a different size, a different number of workers in the household, a different level of income, and a different number of vehicles.

When you add all of these -- these -- we take all of the households that we have and we sift them through different funnels and we create these different household types, and they add up to almost 362 different types of household.

Because those who have workers could make different choices. Those with different income could make different choices. A low-income household is going to make a different choice compared to a high-income household, and a household of ten people could make a different choice compared to one that is -- that has only two people in it.

So, if-- we look at this thing in a systematic way and we try to estimate those models so that we could reflect how much price matters to a household that has only ten thousand dollars of income, how much price matters to a household that has two hundred thousand dollars of income.

So, we take all of these things into account and we all know that, really, there are a lot of other factors that are -- should also be incorporated, such as age. Younger generations are more techy, they are more gadget-oriented (laughter), and they would like to try, actually, the new vehicles. Older generations are not as readily accepting those newer vehicles technologies.

However, our -- while our survey's

capable of identifying the age, our model isn't. We don't account for age in our model. We also do not account for gender in our model, and we know there is a big difference, also, between men and women in the type of vehicles that they are choosing.

So, none of these are really accounted for, and the reason for it is that, if you want to do this, notice we have 362 households that have to choose between hundreds of thousands of vehicle types.

When you multiply everything by each other, it is going to simply blow up the computational capacity of the model. It just requires a whole lot more from the model. As it is -- well, it used to be in 2011, our model was taking multiple hours to run - just one run, it would take multiple hours.

Now, we are doing it in less than an hour for a statewide run. If we increase the regional element, it is going to increase the run time even more, and I can give you just one example from Caltrans, because they are using the CSTD images - California Statewide Travel Demand model.

That model is very, very, very detailed. That model, it takes one week to have just one model run. And you can imagine, if you want to take that much time, you won't be able to do a lot of things here.

We also do the same kind of thing with our businesses. We have businesses of different fleet sizes and they come from different industries. A business who is operating in agriculture industry has a different type of vehicle need compared to one that is working in Hollywood.

Their vehicle needs are different, and so we also segment the commercial sector, and then we get vehicle type choice equations for that sector, as well. I should also add that, in addition to the vehicle and fuel type choice, we also estimate how many vehicles these households are going to own based on the growth in income and population and all that. So, there -- there is more than one equation.

We also determine whether they are going to buy a new or used vehicle. Obviously, if they are buying a new vehicle, they are more likely to buy PEV or anything else. If they buy a used

vehicle, they are less likely to do that. So, we make all of those different distinctions for our households before we come up with -- with the estimate of the total vehicle population in the model.

Any questions, comments?

(No response.)

MS. BAHREINIAN: So, again, I'm going to repeat the same kind of question that I repeated then. We do have vehicle preferences. Our models now have been adjusted to allow us to change the vehicle preferences for fuel type and class over time.

If anybody has any suggestions on those, we would be happy to take those. We also should notice that we don't have any Fuel Choice model. Whereas Marc's entire study was focused on fuel choice, we don't have a Fuel Choice model. And so, for some vehicles, such as PHEVs or FFVs, where they use multiple fuels, it is important for us to know what percentage of the miles in PHEVs are actually E-miles and what percentage are gasoline miles.

If there is any more systematic study, we'd love to do that; otherwise, we are going to

have to apply a given percentage that we may get from different national laboratories on that. Likewise, when it comes to FFVs, we can certainly forecast the number of vehicles -- FF -- fuel -- flex-fuel vehicles, but we can't really say what percentage of the -- of the time they are going to use E85 and what percentage of the time they are going to use gasoline.

So, there are all these different dilemmas. If anybody has input on those, we would welcome that. If anybody has input into the new survey that we are planning to conduct, please let us know.

COMMISSIONER SCOTT: One thought on that is -- I know the Air Resources Board is looking at the number of -- of E-miles traveled. So, we should be sure to trade notes with them, and they probably have the -- the similar type of information for the flex-fueled vehicles, so we should -- we -- we could trade notes with our -- our friends at ARB.

MS. BAHREINIAN: Any other questions?

COMMISSIONER SCOTT: A question I have about the -- the survey, one more, is for -- for -- there's a lot of folks who actually

haven't heard of some of the -- so, for -- for those of us who do this all day, every day, like the -- the battery electric vehicles, like the LEAF or things, and -- and, for the -- for the hydrogen fuel cell electric vehicles, like Mirai or that -- Hyundai has theirs on the road, there's a lot of folks who actually don't know that those vehicles even exist.

And so, how are you going to kind of capture them and let them know that those are -- are -- are real, they're on the road right now, today - they're not kind of this pie in the sky, hypothetical vehicle, so that they can kind of look at all of the vehicles as -- as real choices for them?

MS. BAHREINIAN: Sure. One of the things that we do in that survey -- we don't have time and we don't have the space to go over everything, but that instrument -- the way we did it last time, we had it online, people could look at it, but you could also hover over it and it would explain what each one of these vehicles are.

So, those who were taking the survey online, they could just hover over any little,

different thing and they would get a definition and they would get a description of those. Those who were taking the survey on paper, we had extra sheets of information for them, telling them what these are.

COMMISSIONER SCOTT: Mm-hmm.

MS. BAHREINIAN: In addition to that, for the new survey that we are planning to conduct, we are also going to have an add-on survey of five -- targeting five hundred PEV owners in addition to all the other people. So, we are addressing some of these gradually as we go.

COMMISSIONER SCOTT: Okay. Great. Thanks.

COMMISSIONER McALLISTER: You must be working with -- with ARB, or -- or at least with the ARFETP on that sample, right, to get that -- to get that sample?

MS. BAHREINIAN: We have actually both Caltrans and ARB --

COMMISSIONER McALLISTER: Right.

MS. BAHREINIAN: -- are part --

COMMISSIONER McALLISTER: Great. Okay.

MS. BAHREINIAN: -- of our committee who are working on this.

COMMISSIONER McALLISTER: Okay. Great. Thank you.

MS. BAHREINIAN: Any other questions?

(No response.)

MS. BAHREINIAN: Thank you very much. Bob McBride is now going to talk about VMT and heavy-duty vehicles.

MR. McBRIDE: Good afternoon, Commissioners, public, staff. I'm going to change gears here. Instead of enumerating, I'm going to talk about enumerating all the inputs and assumptions, I'm going to focus on a few key ones that I want feedback on and I want you to think about.

We're looking at underlying components that we depend on to make our projections reasonable, specifically in three pieces of recent work. One, a change in four of our models, all those that involve travel - the Freight, Commercial Vehicle Choice, and Travel, I should say, and our Urban and Intercity models, addressing the miles traveled by vehicles as they age, which I'll discuss toward the end of the presentation.

Second, a new classification in medium

and heavy vehicles, all -- to bridge the gap between vehicle populations that we see in our DMV data and that are published in the Air Resources Board Emissions Factor model, or EMFAC.

Three, and some new data on vehicle movement in general.

I -- like I said, I welcome oral questions today, comments or references to additional, relevant information during the Q&A, or afterwards in writing. Really looking for input.

And I just skipped a slide, so -- there we are. Modeling improvements, medium- and heavy-duty vehicles, vehicle movement. Work at Caltrans and the Air Resources Board can be used for some of the DynaSim inputs in our forecast base year.

For the first time, we're working to classify medium- and heavy-duty trucks and buses to be compatible with the EMFAC classes. We'll apply insight from our work to identify truck and bus fuel/technology types.

We're working with smog check data from the Bureau of Automotive Repair alongside the EMFAC vehicle movement by vintage, resulting from

their similar work over a long period of time.

Sorry, I gotta stay close to my notes so I hit all these point. If I go extemporaneous, I will forget.

Next -- this section, keep in mind the objective of structuring data to build the vehicle population, but the discussion inevitably includes the interlocking effects of vehicle movement, so we're really talking about vehicles here.

I'm going to describe our two sources for vehicle populations, which I already hinted at. Going to present some raw vehicle counts from our analysis of DMV data, describe how we use shared characteristics - identifiers or data fields - to sort trucks into a cross-classification between our DMV data and the EMFAC data.

I'm going to present a preliminary base year 2013 truck stock for the IEPR forecasting this time, in terms of the new classes. A work in progress.

So, independently, for decades, staff at ARB and at the Energy Commission have taken the same DMV data and classified vehicles into quite different classes, albeit for different purposes.

Our own DMV medium and heavy vehicle database identifies a large number of truck body types - looks good, right? But, most compromise really small populations, leaving very large amount -- numbers of trucks in three or four very large types.

ARB's classifications in EMFAC come a bit closer to representing the vocation of trucks and buses, which is key to understanding energy use, but they did not identify the fuel/technology other than what certification rule category it falls under - gasoline or diesel.

We've looked at the characteristics underlying both sets of truck and bus types. The objective has been to take some advantage of the work at ARB and avoid needless differences in our forecast.

We'd rather use some data from EMFAC and, instead, focus attention on how (indiscernible) choice and our five scenarios of fuel price, economic trends, population conditions result in differences between our projections and those from EMFAC.

You might be surprised that the California DMV registration database we receive

does not count all the vehicles moving on California roads. The International Registration Plan vehicles captured -- or addressed in EMFAC includes mostly the heaviest trucks from other states and Canada that travel in California at times, and they also pay proportional fuel and road taxes, which is how we end up with data about them.

This table shows -- excuse me. This table shows our base year 2013 vehicle populations for ten thousand pounds and up by gross weight and fuel type from our own DMV database.

You'll see, in the far right category, I say, over 32,000 pounds. We usually work in the vehicle classes Class 6, 7, 8, 3, 4, 5, whatever. The ceiling for Class 7 is actually 33,000 pounds, but I -- I really defy anybody to find that vehicle that's 32,500 pounds.

Excepting motor homes, diesel dominates all the classes. Natural gas trucks and buses fall into the heavier classes with about seventy-eight percent being over 33,000 pounds. Most gasoline vehicles fall under the -- 26,000 pounds, but still, nearly fourteen thousand of

them are over -- over that.

Hybrid, diesels, electric, and propane trucks and buses in 2013 comprised about three-tenths of a percent of medium and heavy vehicles. We routinely use of gross weight classes or tons, but not pounds, as I said.

I'm going to move on. Buses.

COMMISSIONER SCOTT: Can I -- quick -- quick question on the electric there. Are you including the battery electrics and the fuel cell electrics, or are you just thinking of plug-ins?

MR. McBRIDE: It's everything that is identified in the DMV database with an E.

COMMISSIONER SCOTT: Okay. Got it.

MR. McBRIDE: Yeah, that -- it's -- it's indeterminate, a little bit.

COMMISSIONER SCOTT: Okay.

MR. McBRIDE: In fact, that's a -- that's a good question. I -- I'm assuming most of those are the UPS and FedEx trucks.

MS. STRECKER: I can answer that quickly. It doesn't -- does not include fuel cell vehicles in that electric category. They would be called out separately.

COMMISSIONER SCOTT: Okay. Thank you.

MR. McBRIDE: Yeah, I don't -- I don't see them. They come in the future. So, anyway, I'm on the next slide.

Okay, the buses. Over half of these are gross weight Class 4-6, fourteen thousand to twenty-six thousand pounds. Another just over a quarter or over are in Class 8, the highest weight class. Diesel buses are still in the majority, but a notable -- there's a notable quantity of natural gas buses, twelve percent of the total.

Two additional sources we use for data on buses are worth mentioning. National Transit Database identifies buses, lightrail, heavyrail, et cetera; reports fuel use in vehicle miles by fuel technology, including diesel, gasoline, electricity, and natural gas.

Using this source is tricky because the details agencies report about ridership can be inconsistent from year to year. Still, NTD yields unique data down to that level, the transit agency, which we can use as long as we check two or more years of data at the same time.

Second, 2013 Annual Fleet Survey by the Motor Coach Association casts light into a corner

with little available data. We've never been able to get much out of Greyhound. Private motor coach operators are surveyed and report vehicle populations, ridership, and vehicle miles at a national level.

We use this survey to allocate motor coaches to scheduled service, which is in our Intercity model, to charters and rentals -- large vehicle rentals, our other vehicle model. There -- there's -- which nobody has talked about, this is another simple growth model where we talk about school buses, charter buses, demand response, paratransit.

Here, we describe our method and assumptions for transforming the DMV populations into classes that can be comparable to EMFAC data. Of the DMV counts of vehicles over ten thousand pounds, about eleven percent are not identified by body type at all. I -- we allocate these by region, weight class, and vintage to the known body types. So, we're -- we're saying the unknowns are distributed in proportion to the knowns.

EMFAC includes trucks registered with the International Registration Plan to travel in all

states. In short, the -- interstate trucks, some are identified as registered in California, so we subtract these from our DMV populations to avoid double-counting.

COMMISSIONER McALLISTER: Bob, do -- does the -- so, what's the reason for that unidentified body type? Is it just sort of empty data fields from DMV? Or is it --

MR. McBRIDE: Yeah. There's no data there. It's --

COMMISSIONER McALLISTER: Well, actually, it's -- it's -- the data there says Class 3, unknown body type.

MR. McBRIDE: Okay.

COMMISSIONER McALLISTER: And that means that, when somebody filled out a registration form, they -- it was illegible -- who knows?

MR. McBRIDE: Okay. Okay.

COMMISSIONER McALLISTER: It's a -- it's of -- it's a --

MR. McBRIDE: Yeah.

COMMISSIONER McALLISTER: It's a data collection problem, basically.

MR. McBRIDE: It's blank. It's a data collection.

COMMISSIONER McALLISTER: That's the problem.

MR. McBRIDE: Well, let's let -- let's hear what Gene has to say.

MS. STRECKER: Sorry, I guess I'm the resident expert on DMV right now.

(Laughter.)

MS. STRECKER: So -- so, what happens in -- in the DMV -- like Bob just said, we get the gross vehicle weight reading. And then, there's external analysis that we used to have a contractor do to kind of classify what that vehicle actually is, whether it's an ambulance or a cement truck or whatever it is.

And, in 2010, we were told we had to bring that work in house. And so, we do a lot of that -- that analysis ourself. Depending on -- sometimes you can get some information from the VIN or, you know, if you see that it's Bluebird, you know that means it's probably a school bus, and things like that. So, it's a lot of internal work that's done to figure out what kind of vehicle it actually is.

COMMISSIONER McALLISTER: Okay. That -- that's -- that's helpful. Thank you.

MR. McBRIDE: Yeah, I -- and -- for perspective, there's about a -- a million vehicles I'm looking at over ten thousand pounds, and ten thousand or so, it's about one percent, so.

COMMISSIONER McALLISTER: That's not bad, actually.

MR. McBRIDE: It's not horrible, no. I wish everything else were that good. So, if I go to the wrong place, somebody shout.

EMFAC includes trucks registered with IRP, which we call -- I'm going to call the interstate trucks. So, I'm subtracting the ones that are interstate trucks that are also registered in California from our DMV numbers, so I avoid double-counting. Yeah, I repeated that.

I assigned the interstate Class 8 trucks, over thirty-three thousand pounds, first to move all the commodity volumes that have an out-of-state leg in the Freight Analysis Framework. Oh, yeah, Freight Analysis Framework, done by the Federal Highway Administration, is a forecast of freight volumes and value, done every four years -- or intended to be done every four years. We're working with the 2013 number now, and it is

an earlier forecast. And that actually drives the growth in part of our Freight model, this Freight Analysis Framework forecast.

Next, the interstate trucks are assigned -- okay, first I assign these trucks, the IRP interstate trucks, to the interstate routes in the Freight Analysis Framework. Next, I assign as many of them are -- that are left to move these commodities between California regions, and, if any are left, then they -- they go to freight that Freight Analysis Framework has within California regions. The remainder of the freight gets picked up by Class 8 tractor-trailers that are registered only in California.

Something new, we assume that trucks on interstate routes are pumping fuel outside of California, and this comes from a graduate student work at ARB a few years ago from an intercept survey, where they found, yeah, we -- they all pumped where it was, you know, thirty cents cheaper, over in Wyoming or Nevada or somewhere.

So, to account correctly for the California-registered trucks remaining after all the commodities are moved, we retrain -- retain

these interstate commodity routes in the FAF -- in the FAF data in the model. So, the other trucks that are not commodities, we just assign a -- a -- an amount of activity to them and, if we have a lot more of them that are actually hauling freight in FAF, then we're counting wrong.

Last but not least is allocating the DMV truck and bus populations by their fuel type to the EMFAC classes. As I said before, there -- EMFAC uses certification rules to assign -- to identify vehicles, light and heavy, to either diesel rules or gasoline rules.

And you'll see that diesel and natural gas over -- well, in -- in case of natural gas, over ten thousand pounds, they fall under the diesel rules. Actually, natural gas vehicles under ten thousand pounds fall under the -- I'm sorry, did I say diesel?

Natural gas above ten thousand: diesel. Natural gas below ten thousand: gas rules. But, since I'm not looking at light-duty vehicles, I don't have to worry about that.

Bottom line question for joining these two databases: how do you assign our

interpretation of fuel technology to vehicles in the EMFAC classification? Some vehicle identification numbers, VINs, have a field type -- have fields for fuel type.

One of the digits will code the fuel, but not all of them. Others are identifies by the DMV before we get the data from a proprietary database they use. The basic vehicle data from the forms, again, sometimes identifies fuel type as written on a form. Others are sorted out using gumshoe work, basically, investigation within our own unit, making phone calls, talking to fleets -- fleet managers.

First, we identify the -- so -- taking data sets -- first, we identify the region, the weight class, the vintage, and some of the body types in DMV -- in our DMV data, query the populations with their fuel types over to the same identifiers in the EMFAC-related classes. So, we're sort of moving our fuels onto their -- onto their vehicle classes.

By recent reckoning, about ten percent of the EMFAC trucks fall into gross weight Classes 4-7, one of those interesting -- fourteen thousand pounds to thirty-three thousand pounds.

Some of these were -- fell under the 2010 truck -- truck and bus rules, so they were broken down further to Class 4-6 and Class 7. Others were not.

So, I have a categorization problem here and I'm working it out with ARB staff. Currently, I'm addressing the presence of the separate groups just by assigning them -- assigning them to 4-6, so I'm actually counting, probably, some Class 7 trucks as 4-6. But, we're working on this actively, so this should change.

Freight Energy Demand Model, which is its full name that I didn't even know until -- until I talked to the original consultant, but that's another story.

The truck stock is primarily diesel and gasoline with a few thousand flex-fuel and natural gas trucks. The electric truck population in Classes 4-6 reflects mostly UPS and fleet -- FedEx fleets.

About one in four garbage and recycling trucks are fueled by natural gas. We did not yet know -- I'm sorry, refuse and recycling trucks in Class 8, which is to say over thirty-two -- thirty-three thousand pounds gross.

Many of these will be assumed to pump fuel out of state, due to the higher diesel prices in California. I'm sorry, we're -- we don't yet know the actual fuel type of the IRP trucks.

All we know is they fall under the diesel rule and -- and don't yet have a way of teasing anything else out about that. So, that bottom line could look a little -- a little different in reality.

I've counted gas -- the -- the rule gas and rule diesel vehicle types in EMFAC as a single class when they're otherwise other -- the trucks are otherwise identical. In other words, if you're ten to fourteen thousand pounds in gas and ten to thousand fourteen diesel, I'm going to call it the same truck type. But, when you look at the fuel type, one will be diesel and one will be gas. It's just a data handling mechanism.

So, disregard the -- the counts of the classes in -- and know this. The EMFAC has classes for light, medium, and heavy, most of which can be painlessly recoded to work with our data.

The exceptions lie in that 4-6 and 7

area. For the data presented here, I've added the 4-6 trucks to four to -- oh, I'm sorry, 4-7s to 4-6. This will be revised based on how these classes can be organized. I might have a -- a database management way of dealing with this, as well.

And we have to also, for the first time, organize our truck classes to be able to handle the results of the NPC Truck 5.1 model, which will give us a market share of trucks going forward. And that's -- that -- we haven't done that before, so that should be interesting.

Eight new classes break down this way. Class 3 and 4, through -- Class 3 and Class 4-6 trucks, four groups are Class 8, over thirty-three thousand, and then motor homes and garbage trucks -- garbage/recycling trucks have their own categories. This may change in those -- in that 4-6, 4-7 problem, slightly as -- in the next few weeks.

Now, we turn to vehicle movement, everything that happens after we identify a vehicle population and another critical key to understanding transportation energy consumption. Sure. Yeah, vehicles, what do they do?

EMFAC serves a handful of programs at ARB and we think it's the best available statewide source for data on emissions by vehicle types. I've classified trucks and buses to allow us to use the ARB analysis of VMT, which, incidentally, was done from VIUS, last published in 2002, but that's embedded in EMFAC data. We use that in our Freight model; in fact, we use that in our VMT decay, which I'll talk about later.

VIUS is a critical data set. Everyone agrees it's out of date, but, previously, we analyzed VIUS - independently of ARB, but the value of eliminating this source of variation between the agency forecasts exceeds any benefit from a second look at it. So, we're -- we're holding constant between ARB and ourselves, in terms of the mistakes we're making because we're using VIUS.

COMMISSIONER SCOTT: Is there any way to get updated numbers on that? 2002's pretty old.

MR. McBRIDE: Well, absolutely. And --

COMMISSIONER SCOTT: I heard you say that, but --

MR. McBRIDE: -- Caltrans is in the middle of procurement of a California VIUS --

COMMISSIONER SCOTT: Oh.

MR. McBRIDE: -- spending a lot of money, I don't know exactly how much at this point. But, we're participating along with ARB in a -- in a technical advisory group that's working on a survey instrument and helping along with the -- with the proposal at the --

COMMISSIONER SCOTT: We are looking to get more updated information, but it sounds like it won't be ready for this analysis.

MR. McBRIDE: Yeah, I'm not -- I -- next IEPR, if we're -- if we're lucky.

COMMISSIONER SCOTT: Okay. (Laughter.)

MR. McBRIDE: Yeah. Yeah. That's -- that's my guess. I have no real data on that. Oh, where am I here? So, I'm going to back up. I hope I don't repeat myself.

For EMFAC -- yeah, okay. For EMFAC 2014, the Air Resources Board has revised two key elements. One, they're using Board of Equalization fuel tax data to calibrate fuel consumption. Thus, the EMFAC 2014 fuel consumption values are more robust than the EMFAC 2011 ones.

A scenario -- second, a scenario of EMFAC

now reports VMT, fuel use, and emissions without adjustments to match the MPO forecasts. So, this is their new default forecast that's basically meant to be statewide and shared with the other agencies.

So, before, if we were to use the VMT decay with age, it would have been corrupted by these adjustments made to match the MPO forecasts. Now, they are not. So, they still -- they -- they use smog check data to develop a -- a light-duty trend in VMT with vehicle age for EMFAC, but we'll compare this trend with our own separate analysis of VMT with vehicle age, because we have separate Personal and Commercial Light-Duty Vehicle models -- or -- or Light-Duty Choice models. But, we -- we -- we can combine those in different ways.

Caltrans is producing the 2040 California Transportation Plan, for the first time using the California Statewide Travel Demand model, CSTDM, which is actually five models. I'm not talking anywhere about that, though, but it is an Activity-Based Travel Demand model instead of the aggregate calculation we -- we have used from groups of households.

So, they use a data -- that model uses a daily pattern of activities for the personal side, meaning the purpose of trips -- actually, the models estimate the purposes of trips, and then where do you do them becomes the -- the destination.

So, these are all estimated from data in the 2012 California Household Travel Survey. These day patterns of movement are applied to each household in a simulation for all households in the state, again, based mostly on the travel survey.

For our purposes in this IEPR, CSTDM is a rich set of granular data we're using to populate a number of the bottom-up travel-related inputs to -- to -- to these four models in DynaSim. For example, we're using the vehicle occupancy, trip distance, travel times from CSTDM, and our Personal Travel models, Urban and Intercity.

Don't take VMT in this graph seriously. I'll explain. In 2009 and 2011, we used highway performance monitoring system, HPMS, the National Department of Transportation data, as a validation check on our model output of VMT.

Now, the purpose of HPMS is allocate

highway money among the states, so the emphasis is on consistency across the states. APM -- HPMS data are developed from traffic counts, but they're not validated using survey or model data. This is why we like to bottom-update it from CSTDM.

The amount of error is unclear, but we do believe the shape of the HPMS trend over the years does reflect the actual trend in VMT over the years. The HPMS point estimate for 2013 or any other year is less certain.

This blue line, the trend from EMFAC 2011, reflects adjustment of VMT to values in older MPO forecasts, since MPO forecasts from 2003 to about 2007 were used in that work. The trend in VMT did not reflect the Great Recession. ARB staff have corrected this, reflected in, I think, a January 2013 revision, but certainly in current work on EMFAC 2014. This is one of the reasons our use of some EMFAC data makes sense.

The downward trend in fuel use on the graph reflects -- reflects which are probably the best numbers here -- reflects the increasing efficiency in the vehicle fleet. This graph -- graph sort of projects, hypothetically, the --

the balance that we -- we must achieve in our models before the fuel consumption make sense.

Personal travel of each household - I'm going to turn back to CSTDM for a little more detail, because I spent some time with those people now and with their model output. Personal travel of each household is simulated from data in the 2012 survey.

So, screenline validation is what travel modelers call the calibration method for travel demand -- or a -- one calibration method for Travel Demand models. The on-pavement traffic counts at different locations are compared to model outputs. So, the Bay Bridge or Caldecott Tunnel or -- or would be examples of screen lines. I imagine the Yellow Causeway would be a good one.

We have confidence that disaggregated travel characteristics, like vehicle occupancy, trips per person, and trip distance, from CSTDM are the best statewide data. The -- the aggregate numbers might be improved by using big data, cell phone data or in-ground sensor data. But, we're -- we're good with the -- with the bottom-up numbers.

The main output of CSTDM models is four data tables called the -- the Loaded Networks, representing typical daily travel by vehicle try -- by type, travel -- traffic conditions from morning and evening commutes, an afternoon and nighttime off -- nighttime off-peak periods, converting the daily travel of a typical fall week day as -- which is what is represented in CSTDM, to annual vehicle miles required as a conversion.

Where necessary, we've used the conversions provided in EMFAC 2011 documentation for passenger vehicles, light trucks, buses, and larger trucks.

We've gathered CSTDM data and final resolution that we're using in this IEPR cycle, which aligns with the county resolution available in EMFAC, but we have not scoped or considered in any detail additional data that must be made available at finer geographies for forecasts at -- at any resolution.

Commissioner McAllister, I think that -- does that answer your question about geography?

COMMISSIONER McALLISTER: I'm sorry, I was -- I was -- we were having a little side

conversation here, so I'm a little zoned-out.

MR. McBRIDE: I know.

COMMISSIONER McALLISTER: I'm sorry.

MR. McBRIDE: That's fine. The other --

COMMISSIONER McALLISTER: We were actually talking about a previous slide and --

MR. McBRIDE: Okay.

COMMISSIONER McALLISTER: Just kind of realizing that you're now talking about not just heavy duty but all -- all vehicles, right?

MR. McBRIDE: Yeah, we're -- we're in --

COMMISSIONER McALLISTER: Yeah.

MR. McBRIDE: -- we're back into --

COMMISSIONER McALLISTER: Yeah.

MR. McBRIDE: -- travel, which is everybody.

COMMISSIONER McALLISTER: Yeah.

MR. McBRIDE: So, I've gathered the CSTDM data and final resolution that we're using in this IEPR cycle, which aligns with the county resolution available in EMFAC.

COMMISSIONER McALLISTER: Great.

MR. McBRIDE: But we have not scoped or considered in any detail the additional data that must be available at finer geographies for a

forecast of finer resolution, nor how we're going to deal with model estimation parameters, that sort of thing.

COMMISSIONER McALLISTER: Yeah. I -- I guess -- so, I think, you know, that -- that we're -- we're ideating about things that might, I think, probably be useful in the future, but, you know, the -- the -- and, probably, if we were trying to do all of that right now would be jumping the gun a little bit, because we really haven't seen -- we don't have enough population of alternative-fueled vehicles, probably, to make -- you know, to -- we'd be getting ahead of ourselves a little bit if we tried to drill down into the -- into the specific geographies.

But, you know, we might think about using L.A. or picking a county to sort of do the first run on or something - you know, San Diego or L.A. or -- or some -- yeah, some -- where -- where there're more vehicles and then maybe where the MPO is a little -- is a little ahead of the game and a little more sophisticated to -- to -- to try to get our heads around a methodology that, then, we could use when we really get to it down the road.

MR. McBRIDE: Yeah, I've --

COMMISSIONER McALLISTER: So, I don't know --

MR. McBRIDE: I --

COMMISSIONER McALLISTER: I don't know how that sounds to you, but I -- I'm just thinking that probably is a good strategy.

MR. McBRIDE: Well, I -- I've backed away from thinking about finer geographies and thinking about where do we want detail, to answer the questions --

COMMISSIONER McALLISTER: Yeah.

MR. McBRIDE: -- we really want to ask --

COMMISSIONER McALLISTER: Yeah.

MR. McBRIDE: -- and it might be another aspect of the -- of the models. So, anyway. Sorry, we'll compare our analysis of smog check data for personal and commercial light-duty vehicles with the ARB analysis of smog check data that's in EMFAC.

One likely course of comparing and combining these is to calculate the relative slopes of the personal and commercial VMT trends with age -- with vehicle age while constraining their population-weighted average to the trend in

EMFAC. But, we'll -- that's just one idea.

Medium and heavy truck VMT by vintages based on ARB staff analysis VIUS data, again, Vehicle Inventory and Use Survey, vehicle inspections, I learned are no longer involved in these estimates. Twenty. Good.

Freight Analysis Framework estimates the forecast between regions. We use this to calculate vehicle miles, considering the average payloads and the unladen movement or truck deadheading. Again, using data from VIUS.

FAF depends on data from the Commodity Flow Survey, which is part of the economic census. Other trucks, which can -- we can call service activity trucks, as opposed to commodity trucks, they're the VMT by vintage that's output from EMFAC.

Earlier, we saw -- we explained how the IRP or the interstate trucks and some Class 8 tractor-trailers, to haul -- haul commodities forecast in FAF. Recall that we assume trucks on interstate routes pump fuel outside of California. We also know from VIUS that some services are performed using interstate trucks, but I'm not certain how many interstate trucks

with a home base in another state are leased for use within California, so there's some -- still some shadowy areas.

We're asking anyone with insight on this to comment. Let me know anything about IRP or interstate trucks that I'm missing. For the time being, we'll sign the remainder of IRP trucks to the Interstate Service sector and assume that fuel is pumped out of state. We might do that or we might simply run out of interstate trucks by the time we deliver all the commodities.

I believe the most compelling addition to the DynaSim models for this IEPR is the ability to capture how the miles driven for a vehicle changes as it gets older. For the models with travel components, many light vehicles and trucks, being commercial vehicle choice urban, intercity, and freight, we've added an equation to allow for the profile of VMT decay with age to affect the fuel consumed. Well, to affect VMT and the fuel consumed. EMFAC has this capability supported by an established methodology and more staff with long experience, so we're going to rely on them some.

We expect a shift -- we expect in the

forecast a shift towards fuel efficiency and alternative fuels in terms of consumption. The vehicles obviously don't change, but that might be apparent as compared to the models without the VMT decay. Let's see if that's true. (Laughter.) For -- for light-duty vehicles, we'll start from the EMFAC analysis and differentiate between personal and commercial use.

The odometer readings and dates in smog checks are the source of this VMT decay. So, the huge samples - millions of smog checks a year - promise -- or suggest, anyway, that our estimates of VMT decay will end up pretty robust. For medium and heavy vehicles, we piggy-back on the ARB staff -- staff analysis of smog check that's already in EMFAC.

Now, I'm going to skip one slide, here. I'm going to come back to this. I'm going to make sure -- and I'm on -- I'm on twenty-four. Thank you for listening. That -- oh, twenty-four is back up here. I switched it in my notes. Oh, okay, this is what I just talked about. Sorry. Okay. Now, I'm going -- twenty-four, I'm going back to twenty-three.

So, here's our graph. Here's the first look at the decay applied to the -- to the eight truck -- the new eight truck classes. Notice the high annual mileage of the interstate trucks in black.

And, as we have yet to explain, the mostly-flat VMT trend with age for Class 8 garbage and recycling trucks, that's down there in solid green. Notice how that barely moves. I'm going to figure out why.

So, thank you for listening through this window into our work. We sincerely hope for enlightening comments, questions, additional information to help us refine the IEPR 2015 Transportation Energy Demand Forecast.

Are there questions in the room?

(No response.)

MR. McBRIDE: Okay.

COMMISSIONER McALLISTER: I -- I want to thank you, Bob, and just the -- the -- all the data sources you described, I think -- you know, I mean, I've got enough experience doing research and everything that I could just imagine getting these huge data sets from, you know, the source and then having to clean them up and put them

together and order them and -- and then, you know, use them and -- and I -- I -- you know, kudos to you guys.

I think quite a big task, and I think the way you're structuring it and setting it up is -- is going to be very valuable, so I appreciate that. It's nice that it -- I feel like we have gotten a window, as you said, so.

(Laughter.)

MR. McBRIDE: Thank you.

Who's next? I think I --

COMMISSIONER McALLISTER: Anybody have any questions?

MR. McBRIDE: I'm introducing Jesse Gage, who's going to talk about the High-Speed Rail model, if I'm correct?

COMMISSIONER McALLISTER: I wanted to just acknowledge, first, if I can just jump in here - we have a representative from Caltrans and I don't know if -- if he's still in the room -- oh, great. Dillon Miner.

And, Bob, you mentioned Caltrans a couple of times and I -- I don't know if Mr. Miner is involved in those efforts, but maybe you could chime in and -- and we're happy to have you here.

Thank you.

MR. MINER: Thank you, Commissioners, and for all the presenters today, it's a wealth of information and really interesting, so thank you.

My comment is for the light-duty vehicles and also the vehicle technology and fueling stations, so I'm not sure if he just walked out of the room, but my question had been, in regards to other reports I had heard that suggest that drivers looking to purchase battery electric vehicles, alternative fuel vehicles, are concerned with range limitations and get range anxiety, and yet the charging that's done is still mostly residential, as opposed to public EV chargers, fast chargers being the exception.

And so, my question is, when we're looking at how consumers are creating their preferences for vehicle purchases, is there consideration being given to the -- aside from the immediate impact of that range anxiety and the need for fueling stations, are there other behavioral models that suggest alternative ways of dealing with that range anxiety?

Like, one suggestion that I think you came up with was just increasing driver awareness

and allowing them to rent vehicles to gain experience on how these vehicles operate.

Just because it -- it seems like, if we continue to assume that we have to have a certain number of chargers to reduce that range anxiety and yet they're not being used, it's worth considering behavioral strategies rather than entirely infrastructure-based.

And, especially within Caltrans, that's something that we are interested in and need to continue working on is to see to what extent we need to help to deploy -- help the state to deploy charging stations versus providing better education to drivers. Thank you.

COMMISSIONER McALLISTER: Thanks very much.

That sounds like that's for you, Aniss.

MS. BAHREINIAN: Yeah. The new survey that we are planning to conduct also is, as I mentioned, a PV owner survey and those are some of the type of questions, if you're going to try to answer regarding to vehicle utilization and charging behavior, so we will be addressing all of those decisions, et cetera.

But, the example that I gave, that I just

read, actually, yesterday about, was -- was in France - in Paris, actually. The idea was to expose people to EVs by just renting them these vehicles by minute and they -- they charge, I think, by hour or by minute.

And the hope is that, after the consumers are using those, then -- you know, on a rent -- rental basis, then they will choose to purchase those vehicles. That's -- I haven't heard of that here in the U.S. That is in France. It's something that maybe we want to consider.

COMMISSIONER SCOTT: I'm on the -- the Plug-In Vehicle Collaborative and one of the things that we also look at are a lot of ride-and-drives, and it's -- it's the same idea, so we're not renting the cars to -- to folks through those ride-and-drives, but just the opportunity to, again, have the chance to experience one, see what driving one feels like, see what plugging one in feels like.

And so, it's -- it's -- it's the same theory, though, making sure that folks are exposed to the -- to the vehicles. And we -- and we're working very closely, I think, with folks on your team at Caltrans to look at where some of

the charging infrastructure ought to go.

As -- as you know, the -- the -- that's a pretty complex area, because it's -- it's continually changing, as the -- the charging technology itself is changing, the range of how far cars can go is changing, and the Public Utilities Commission has allowed now the investor on utilities to put pilot proposals before them, and so, we'll have to -- when we're thinking about where the state wants to continue to make its investments, we're going to have to be nimble and flexible and continue to kind of stay on top and monitor everything as it changes to figure out where the places that we need to continue to put chargers to help the expansion of the market.

And -- and Marc Melaina, who's right behind you, from NREL, they did a great study for us last year to see if we're going to -- to meet the governor's 1.5 million zero-emission vehicles by 2025, how much charging infrastructure do we need in place for those vehicles to be able to charge up? So, we've got some really good data about that.

MR. MINER: Thank you for responding to all that. And, I guess, just wanting to

reiterate the point that, in all of the work that's being done to identify those locations and make sure that we have enough stations, that we're not assuming that drivers are going to be using all of them and how we address that in terms of -- you know, is it just the visibility of the stations that are there, or is it really the number that's going to have the bigger influence when it comes to the public facilities? Thank you.

COMMISSIONER SCOTT: It -- it's a great question. I think it's -- I -- and I think, right now, it's kind of a combination of both, the -- the technology, I think, is still new enough that people don't know, and so it's helpful for them to be able to see chargers wherever they want to -- to go or in the places where they think they might like to charge up.

But -- but, then, you know, if you're looking at a workplace, for example, you put five chargers there and, the next thing you know, they've got more vehicles that are trying to plug in at the workplace than they can handle and they've got to expand, and so it just -- it really does depend kind of on where you are

and -- and, again, all of that's going to continue to change as the -- the vehicles get more range, as the tech -- the charging technologies change, so it's a -- it's a -- it's a dynamic and interesting space.

MR. GAGE: I guess I'm up. I am Jesse Gage of the Fuels Unit and I will be discussing today the Personal and Commercial Vehicle Choice models, as well as our new high-speed rail algorithm. I'm actually getting off a little easy today, as batting nearly last means most of the inputs for the Vehicle Choice models have already been spoken for.

I will just quickly run through those items before covering two other inputs to the models which have not been discussed, namely the American Community Survey and data from the smog check program, which Bob did mention earlier but is used in a rather different manner here.

Separately, I will be discussing high-speed rail and its incorporation into our Transportation Fuel Demand Forecast. This is the first time HSR has been discussed in a forecast context here at the Energy Commission that I'm aware of, so I think HSR's history and future is

worth a look today, along with how we expect HSR to impact California inner city travel and how we will be using the high-speed rail authority's forecast to augment our own forecast of overall fuel demand.

As I mentioned, most of the inputs to the Vehicle Choice models have already been covered in-depth. Specifically, both personal and Commercial Vehicle Choice models use the economic and demographic data covered by Nancy Tran in the February 26th workshop, vehicle stock data, which comes out of the DMV database, Gene spoke about this morning, fuel and electricity prices by Ysbrand and vehicle attributes, which Tom Carlson of Sierra Research discussed just before lunch.

The Personal Vehicle Choice model also employs the American Community Survey, administered annually by the United States Census Bureau, while the Commercial Choice model uses smog check data from the Bureau of Automotive Repair.

The American Community Survey is an annual poll of about one million U.S. residents, which clocks in at about fifty questions and serves as augmentation to the decennial census.

The Census Bureau provides a sanitized version of the survey responses for public use and it is this publicly-available data set which we use here.

Specifically, the survey provides us with information on household size, number of workers, income brackets, number of vehicles, all of which are factors when it comes to what sort of vehicles people purchase.

The proportions are then applied to our statewide population projections from Moody's, IHS Global Insight, and the Department of Finance to get an overall picture of California's demographic makeup as it applies to personal vehicle purchases.

Those of us who have yet to make the switch away from the internal combustion engine are familiar with the Californian ritual of paying fifty bucks every other year to get your car smogged at some place on Folsom Boulevard. The mechanic collects an awful lot of data about your vehicle in the process, which is sent to the Bureau of Automotive Repair, or BAR, who stores it in its own database.

We receive this data through an

interagency agreement in a manner similar to the database we get from the DMV. This amounts to information on over ten million vehicles, which are smogged each year, and tracking vehicles over time can give an estimate of vehicle miles traveled per year.

Among this sea of data are three items in particular which are useful for our own purposes: the vehicle identification number, or VIN, the test date, and the odometer reading. Our data goes back several years, so, by trawling through the dozens of gigabytes, we can see the same car appearing multiple times.

For example, my little '98 Corolla appears in 2009, 2011, and 2013. Taking the difference between odometer readings and dividing by the length of time between appearance -- appearances yields an average for annual VMT for that vehicle.

These calculated VMTs are filtered for inaccuracies using guidelines BAR has used in their own reports and the VINs are matched to the DMV database, where we get vehicle class and ownership information, which an aggregate gets us an average VMT per vehicle class slash vintage,

which then goes into the Commercial Vehicle Choice model. Incidentally, the smog check data is only necessary for the commercial model. The equations in PBC are different and do not rely on VMT as an input.

Using smog check data does carry with it one key assumption. Only gasoline and diesel vehicles are covered by the smog check program, and, with no other data currently available to us, we are forced to make the assumption that natural gas, PHEV, and hydrogen vehicles are driven -- driven similarly to their combustion engine counterparts of the same class and vintage.

Also, gasoline -- I'm sorry. That said, if listeners have a different take on the fuel/VMT relationship, we would love to hear it. That takes care of the Vehicle Choice models, so let's switch over to HSR.

High-speed rail, as a concept in California, has been bandied about for over a generation now, going all the way back to work with Japanese investors in 1981 towards an HSR corridor in Southern California.

However, nothing really got off the

ground until 1994 with the passage of the High-Speed Rail Development Act, which formed the Inner City High-Speed Rail Commission to report on the feasibility of an HRS -- HSR system in our state. Two years later, the HSR Commission reported back that, yes, HSR is feasible and can be profitable in California. Let's do it.

Senate Bill 1856, passed in 2002, authorized a rail bond initiative to be sent to the voters for approval. However, the proposal did not appear on the ballot until 2008, where it was passed as Proposition 1A.

Along with federal funding sources, the Budget Act of 2012 appeared -- approved moneys for the initial operating segment, or IOS, which we'll cover in the next slide. The HSR Authority's most recent of its biennial business plans was published in April of last year, and construction proper began last June.

The full route of high-speed rail in California is to stretch some five hundred miles from San Francisco to Anaheim. However, the current plan for high-speed rail in California is not to wait for the entire line to be completed before cutting the ribbon and running the trains.

Instead, it will be completed in stages. To start, the initial operating section - again, IOS - will run three hundred miles from Merced to the San Fernando Valley, with a projection completion date of 2022.

Following this initial line is the Bay to Basin section, which extends northward to San Jose, in 2026. The Phase One section, five hundred twenty miles from San Francisco to Los Angeles and on down to Anaheim, is slated for completion in 2028. And, beyond that, lies stops in Sacramento and San Diego.

All these expansions, however, lie beyond our Fuel Demand Horizon Forecast -- or forecast horizon of 2026, except for Bay to Basin, and we don't know when in 2026 the Bay to Basin stretch will be open for business. As such, we will only be considering the IOS portion of the HSR network for purposes of our forecast.

Our HSR algorithm leans heavily on the CalHSR's 2014 Business Plan. This is by design, as CalHSR asked us to use their forecasts whenever possible. This is why I have been referring to our HSR model as an algorithm, rather than a forecast, as the actual forecasting

is done on their side of the fence.

Our model takes as inputs CalHSR's forecasts of ridership, displacement, which I'll touch on shortly, the length of -- of both the rail line and additional addition -- necessary travel and properties of the trains themselves, such as capacity and electricity consumption.

Displacement warrants a bit more discussion. The addition of high-speed rail as a travel option will create a somewhat complicated shift in the way people travel up and down California.

Some passengers will take HSR in lieu of flying, some instead of driving. Others would not otherwise have traveled at all and just want the novelty of taking two-hundred-mile-an-hour selfies.

(Laughter.)

MR. GAGE: All this means we take vehicle miles away from other modes and move them into the HSR column. However, during the IOS portion of the buildout, passengers are still going to need a way to get to, from, say, San Francisco, to Merced, and from Merced to L.A. Or, from San Fernando Valley to L.A. Be it auto, feeder

buses, or conventional rail.

This means a family who would have otherwise traveled the full route by jet may instead, say, take a bus from San Francisco to Merced, take the bullet train down to the San Fernando, rent a car for their trip to Disneyland, and then, on the way back, do the exact opposite. This means the air travel VMT has shifted not just to HSR but to two other modes, as well.

Fortunately, CalHSR has done much of the work for us and have provided a forecast of these mode shifts, and we will be incorporating their projections into our own model. For the preliminary forecast, CalHSR's forecast will only be used as an add-on to our reference scenario.

This is because the economic and demographic assumptions used for CalHSR's base scenario aligns well with the Energy Commission's own reference scenario. We do not believe their other cases match up as well with our other cases, in terms of econ and demographic data -- or assumptions.

And so, at this time, we don't think it makes sense to apply their forecast to our high

or low cases. We plan on taking another look at this, however, between the release of the preliminary and final forecasts, we might be able to apply it more broadly.

Finally, and this is where the big asterisk goes, a word of caution. If one were to look at the overall impact of HSR on fuel demand as a whole in California, comparing it to the twenty-billion-odd GGE California consumes per year, that needle will not be moving very much, especially in the early IOS stages where ridership is still ramping up.

HSR will likely divert somewhere around a billion passenger miles per year, but Caltrans's VMT estimates for 2014 stand at over 185 billion on state highways alone, to say nothing of service street travel, aviation, conventional rail, et cetera.

Where we can expect to see a larger impact will be on interstate -- intrastate aviation, but this is only, I believe, somewhere around fifteen percent of overall air travel originating from California airports, although Gordon may have something to say on that later.

Finally, I'd like to take a quick look at

the HSR algorithm itself as we currently envision it, although keep in mind this is a work in progress and may change based on the information we get from CalHSR.

It starts with CalHSR's forecast, where we receive projection HSR ridership and mode share displacement. This gives us the total number of miles HSR passengers will be traveling. This is split up into HSR and non-HSR miles.

For the HSR portion, a little easy, we simply apply the length of the rail line itself, the projection number of trains it'll run over the year, and its energy consumption, and we calculate HSR's energy use.

For beginning -- the beginning and the end of the journey, we have to determine the net impact of each mode's VMT and compare it to the reference forecast without HSR applied. So, for example, if the net result of HSR reduces air VMT by, say, ten percent, then our HSR algorithm or overlay produces a so-called negative fuel consumption of ten percent, reflecting the displacement of pre-HSR jet fuel consumption.

And that wraps up my presentation, and I'll be happy to take your questions at this

time. I kept it brief.

COMMISSIONER McALLISTER: Thanks very much. I don't have any questions.

I -- I mean, this -- this timeline -- I mean, this is a huge, huge project, obviously, and we're basically just getting our ducks in a row to sort of anticipate this work going forward when it really -- when the numbers really sort of ramp up and it does affect the other modes.

I guess, what -- well, I'll just leave it at that. I think it's good to see you, you know, working at that and getting -- getting the high-speed rail incorporated in the analysis as we go forward.

Do you have any --

COMMISSIONER SCOTT: The -- the other question that I had on this, although it might not be for you because we're looking at it from the transportation demand side, is the -- the electricity demand side that goes along with powering the high-speed rail, and I just can't remember from the -- the workshop a couple weeks ago how -- how we were planning to calculate that.

MR. GAGE: I will be calculating that

from the -- wait, so, the -- the properties of the rail cards and their ridership estimates, I might actually have flat-out consumption estimates from CalHSR themselves, at least for the trains, if not for the stations. So, I think, by the top of our next forecast for the preliminary forecast, I should be able to have those figures for you.

COMMISSIONER SCOTT: Oh, great. Thank you.

MR. GAGE: No problem.

COMMISSIONER McALLISTER: So, will that -- so, will we -- I mean, is Ivin in the room still? It looks like not. But, will that -- will you be -- assume -- I assume you'll be working with the electricity forecast folks to incorporate -- to make sure we're consistent across the different fuel types?

MR. GAGE: That is correct.

COMMISSIONER McALLISTER: Great.

MR. GAGE: Okay. And last but not least is Gordon with aviation.

MR. SCHREMP: Hello, again, and good afternoon. This is Gordon Schremp, senior staff in the Energy Assessments Division of the Energy

Commission.

So, I -- I'm hearing the Commissioners talking about being consistent. That's -- that's -- you know, they preach that a lot, so I just want to, for the record, note that I, too, have a 1998 Corolla like Jesse --

(Laughter.)

MR. SCHREMP: -- so staff is endeavoring to be as consistent as feasible --

MR. GAGE: And did I say --

MR. SCHREMP: -- on a day-to-day basis.

MR. GAGE: -- it hits 200,000 miles this year? I'm very proud of it.

COMMISSIONER McALLISTER: Wait, did you -- did you say Victrola or Corolla?

(Laughter.)

MR. SCHREMP: Very nice. I actually have 232,000 on mine, so. I take ands smog it every two years.

(Laughter.)

MR. SCHREMP: So, we saved the -- the best 'til last, aviation fuels. I know that you've all been hank -- you know, have a hankering to see what's going on here. I won't have any data, which really don't have a forecast

ready at this point, but we will when we unveil the preliminary numbers, but I'm going to be talking about what encompasses aviation fuels. I'm going to talk about what our -- our forecast approach will be, since it is different than -- than was mentioned this morning, taking it out of DynaSim. So, we're going to take a different approach.

So, there're basically three types of aviation fuel. Aviation gasoline is in piston-driven engines for light -- light-duty aviation at airports. Fixed-wing aircraft and military jet fuel, two flavors as you see in the slide here, JP5 and JP8.

JP5 is a designation for -- in marine environments, so you'll see naval aircraft off of aircraft carriers using a JP5 formulation - changes the flash point, because it's onboard a -- a naval vessel.

JP8 is -- is for all other military aviation craft usage, but is something that is a -- starting to change. And commercial jet fuel, which is the norm - it's a global specification, essentially - purposely so, so aircraft making international travels can have a

consistent fuel to use in their turbines.

So, we do -- we do obtain some historical information. The easiest, certainly, is aviation gasoline. It's just a monthly Board of Equalization taxable fuel figure. It's a very modest number I'll show you in the next slide, here.

Military jet fuel is much more -- it's a tougher nut to crack. We have to do a rather involved supply-demand balance using all of the military base volumes from the solicitations and all of the addendums to said solicitations by Defense Logistics Agency.

So that has -- the slide says about sixty-seven different locations, so we do balance as multiple states, because of where the fuel is initially delivered, and then either trucked, pipelined, and, in some cases, marine-vessel-moved.

So, we do a Northern California/Southern California/Nevada/Arizona/New Mexico balance on the annual basis for this. The reason we do that is because there is no Board of Equalization commercial jet fuel total figure. Here you go, here's your -- here's your sort of consumption.

Yes, there is one, but it's only for, basically, BizJ, private jet application, taxable events. So, there's a very small quantity of jet fuel that some -- some people might misinterpret as being, you know, commercial jet fuel used in California. It certainly is not. Jet fuel use is -- is closer to that of diesel, an excess of three billion gallons a year, for commercial jet fuel.

So, we have to look at our data sources to do a supply-demand balance for jet fuel to come up with a historical number and, therefore, we have to know what has come in as military jet fuel.

And there is no -- there's not clean and consistent designation on our import/export forms saying, that's a military jet fuel import. There really isn't any foreign military jet fuel import into California, because these contracts are let, usual -- usually locally, either in a California or Pacific Northwest refinery.

They are -- they are -- a couple of refineries will get a contract every fiscal year and they're the ones producing the military jet fuel for basically the West Coast. And so,

really, you won't be coming from a foreign source, but we do have in -- intrastate movements between Washington and California, California-Oregon, so -- so we need to sort of understand what the jet fuel balance is, first for military, and then what else is coming in we assume is Jet A.

So, this is how we end up creating both -- killing two birds with one stone. We end up with both the military jet fuel and a Jet A historical number each year.

So, here's what the numbers look like. The main takeaway here is, certainly, the dominant of the three is commercial or Jet A, ninety-one percent, plus military is most of the balance because aviation gasoline is less than one percent, the small, little, red bar at the bottom of these annual stacked bar charts.

So, there is a -- a -- you know, demand projections. We won't have this part of DynaSim. We will not be looking at aviation gasoline. It's a very, very modest -- it actually hasn't been going up as fast as a -- say, gasoline in the last couple of years.

There was certainly an impact, because of

the recession, on private flying with aviation gasoline, but -- so, but we're -- our -- our focus is really going to be on commercial jet fuel.

So, it's interesting to note the military, besides looking at trying to diversify fuel use with, say, alternative fuels in some applications, the military is also looking to move away from JP8 and go to Jet A.

That's actually happened in California now, for the most part, we understand, Utah in the -- into Arizona. So, as their new car -- as the new contracts come up, they'll be changing the specification on what that fuel is.

So -- so, now, we'll have to sort of take into that account that it's not a military jet fuel, so this will affect both our historical analysis going forward as well as projecting what total demand for jet fuel and Jet A -- so, we'll actually have a military component and a commercial component for that.

So -- so, what do we do to figure that out? I think this morning there was a mention that we're going to have a different model. Well, I -- I think that's quite a stretch to say.

We're going to be using a model - just, really, we're going to be using relationships between historical fuel consumption by, say, in plane passengers to go and look -- and dovetail that with what the projections are for passengers moving forward, as well as some fuel projections nationally. So, I'll talk a little bit about that.

So, historical aviation data from the Bureau -- Bureau of Transportation Statistics, or BTS, is pretty extensive in the aviation arena. As I allay here in these sub-bullets, what we're looking for is really, for California purposes, you're able to extract out activity by individual airport.

So, it's very helpful, so you'll see what are, say, domestic/international destinations, you'll see in-planed passengers, cargo tons, estimated plane miles, ton miles for cargo movement, and passenger mile -- miles for passenger movements. And then, cargo does have some passengers on there, too, so it's all -- it's all broken out.

So, why that's important is it allows us to look at this information in the -- in the

context of how much fuel is being used in a particular area. Now, the data on -- on a historical basis is by individual carrier, so they'll say what I did in -- in some of these segments, so it's not as clean as saying, here's the total fuel used at this airport over this period of time. It's not as -- as precise as that. That would be best, but that is something that you can obtain nationally from this data set.

But, going forward is what we're interested in is how is air activity going to change? So, it's fortunate the FAA does have a -- an annual publication and a -- a compendium for the -- forecasts they do every year. It's very helpful.

They will have national projections on -- and, besides, the passengers, the freight activity, domestic/international destinations, and, most importantly for our purposes, it's actually the fuel consumption for both domestic routes as well as international routes.

And to give you, I think, a good comparative, the -- it's important to know that because the amount of fuel consumed per in-planed

passenger, the difference between domestic/international is pretty significant.

I think ballpark figures are domestic in-planed passenger fuel consumption is twenty-five gallons and then you can look at the international average for a year could be eighty-something gallons.

Well, clearly, if you're leaving most of the international flights leaving, certainly in the West Coast, are going to be traveling a -- a long way. They're usually going across the Pacific, and so that's not just a -- you know, there's certainly traffic down to Mexico, Central America, Canada, things like -- but they're a smaller portion of the overall flight and certainly overall passenger miles, if you will.

So, we look at -- at these forecasts by individual airport in California to extract what those in-planed passenger counts are. Unfortunately, they're not going to tell you that those are domestic and international routes.

So, what we have to do is -- is look at what that national trend is over time from that relative mix, and what we do is we actually adjust the California historical relationship

between fuel consumption and in-planed passengers to be a slightly higher average to reflect what goes on in California is different, and then meet that up with what that trend is going forward.

So -- so, it's probably a much more simplistic approach, if you will, than what we I think attempted in the past, but this is really more of a -- a staffing issue, trying to work this through DynaSim, so we felt this would be maybe an interim step to try to at least have a jet fuel forecast as part of the companion forecast moving forward this IEPR cycle.

So, how -- I mean, in -- in these -- this analysis and forecasted FAA does and they certainly have lots of assumptions about how well planes are improving their fuel consumption - becoming more and more fuel efficient.

That's through design change, winglets, how they operate the engines, improved engines, engine efficiency, going to two engines across international flights. So, they become quite adept, the industry has, at reducing the fuel consumption per passenger mile.

So, that's expected to continue and FAA incorporates what they believe are these

technological improvements over time. And fuel prices certainly have been in that mix as of recent years, but, as was mentioned this morning, there's been a collapse in -- in fuel prices benefiting the airlines, certainly, in their bottom line because fuel is a very high percentage of their operating cost -- is the fuel component.

So -- so, that's all -- that's all incorporated in FAA's analytics for their forecasting that -- that, you know, generate the national and some of the regional information.

So, like I said, we -- we don't just go with what they have. We actually do change the -- the fuel -- the plane passenger fuel consumption estimate, and so we'll raise that up a little bit more.

Another important point here, as you've heard this morning and even this afternoon, that there are certainly bounded forecasts we produce. We think that's valuable information to provide at the Energy Commission.

There's basically a single-point forecast from FAA. So, I guess you could say that's reference. So, how -- how does one come up with

a bounded forecast? So, certainly one adjustment that we're suggesting - and we're happy to take comment from stakeholders - is varying the international component within the California originating routes over the forecast period.

A little heavier international will surely increase the demand for fuel, and then -- and, conversely, decrease it. So -- so, that's one suggestion to end up with a bounded forecast.

And I was remarkably brief, which you can go home and write in Dear Diary today --

(Laughter.)

MR. SCHREMP: -- in one of my presentations, so.

Any questions? I'd be happy to answer at this time.

COMMISSIONER McALLISTER: Just curious - is the international component really a function of having LAX or are there other airports that -- that contribute significantly into that?

MR. SCHREMP: Certainly, LAX and SFO, San Francisco Airport, have some significant - when you look at the historical data --

COMMISSIONER McALLISTER: Transpacific.

MR. SCHREMP: -- yes. That's correct.

COMMISSIONER McALLISTER: All right. Great. Thanks.

Any questions?

COMMISSIONER SCOTT: No, I don't.

COMMISSIONER McALLISTER: No?

COMMISSIONER SCOTT: No. Thanks.

COMMISSIONER McALLISTER: Okay. Great. Thanks, Gordon.

COMMISSIONER SCOTT: Thank you, Gordon.

Okay. We're ready for any public comments I think at this point. Does anyone have any comments in the room? Are there cards?

COMMISSIONER McALLISTER: A couple of cards.

COMMISSIONER SCOTT: And we don't have any questions on -- oh, yes, go ahead, please.

Can you stand up, I'm sorry, and come to the center microphone and introduce yourself, please?

MR. HERBERT: I'm Jeremy Herbert with the Air Resources Board, and I would like to express appreciation for putting on this workshop, bringing in this much internal and external knowledge into one area to discuss travel demand forecasts. It's very valuable and it's very

informative. I'd like to thank you all for it.

Just two comments that I -- or three, maybe, comments I have is one is I think all the people that presented on these comments are gone now, but in the -- in the fuel price forecasting model, on Slide 6, it mentioned that the -- the fuel blend was going to be -- remain -- assumed to stay stable and not change at all.

And I'm not really familiar in how sensitive the model is to fuel blend changes, but there will be a significant change in fuel blend due to LCFS regulation. And so, I -- whether it's significant or not, I couldn't tell you - or if it's sensitive in your model or not. That was one comment I had.

MR. SCHREMP: I'd be happy -- this is Gordon Schremp. I'd be happy to answer that.

I think what was mentioned this morning is that there's an initial forecast that's generated and there are assumptions on the vehicle stock, whether it's light-duty vehicle, emission gasoline engine, diesel vehicles, alternative fuel vehicles.

So, that's really not being altered in -- in initial forecasts generated. We do some post-

processing analysis of the initial forecast to look at the mix of fuels vis a vis the low-carbon fuel standard obligations, and -- and what ends up happening is basically the mix-up alternative fuels may shift.

For example, ten percent ethanol in gasoline assumed, going forward with no E15 in the forecast, it's not going to change the quantity of ethanol, but the LCFS will certainly change the source -- originating sources of ethanol to say maybe more Brazilian, more cellulosic over time, but the total quantity would remain the same.

So, that's one example; however, there are assumptions that, going forward in the LCFS, we'll see more and more drop in fuels - non-hydrocarbon gasoline, non-hydrocarbon -- I mean, from crude oil sources, diesel fuel.

So, those kinds of materials to the extent that we're assuming there's increased penetration that's actually going to displace some of the petroleum-based gasoline and petroleum-based diesel that we'll have to account for.

So, I think, in that -- in that case,

you're going to see a change of the mix, but the total volume from the preliminary forecasts won't be altered because of that.

MR. HERBERT: Thank you.

And also, you mentioned earlier, Commissioner Scott, and I'd like to support your comment that renewable hydrogen -- that it is part of the blend.

Internal staff estimates that the trigger -- the volumes of hydrogen produced will trigger this - be 1505 before 2025. And so, and in fact currently there is estimates that there are currently even more than the thirty-three percent renewable content currently in what's being produced in hydrogen now.

COMMISSIONER SCOTT: Thanks for that. We'll probably circle around with you to get the -- the additional data.

MR. HERBERT: Okay.

And then, the other comment I had was on -- in the vehicle attributes forecast, on Slide 12, it mentioned that Vision Scenario 2 was used to -- to align with the ACC regs and how many vehicles were in the fleet.

And I just wanted to mention that the --

the model that was run back in 2012, with the Vision Scenario 2, that was an aspirational scenario that attempted to attain the 2050 greenhouse gas goals, and that wasn't one that was used to align to the ACC regs.

So, there has been further refined analysis and scenario work by the Vision program at ARB that had -- that's a little bit better for EV and PHEV and all of that penetration into the market.

COMMISSIONER SCOTT: We'll probably follow up with you on that one, as well.

(Laughter.)

MR. HERBERT: Well, that's all I had. Thank you.

COMMISSIONER SCOTT: Thank you.

COMMISSIONER McALLISTER: Thanks for being here. The agency work, I think -- you know, we have not maybe held it up to the -- it hasn't been front and center here, but I think, clearly, this forecasting work and then across the -- really the whole IEPR and many of the themes that we are working through really demand and require their agency working -- you know, working groups and a lot of collaboration and

data exchange and expertise exchange and that's really critical, and ARB is one of the -- one of the -- ARB and Caltrans today -- but -- you know, on the electricity front.

It's -- we tend to think of it as ARB and PUC and -- and the ISO, but really a lot -- now, the Water Board and Caltrans and others are really critical to a lot of what we do, so we appreciate your being here and your support on this.

COMMISSIONER McALLISTER: All right. So, pass it back --

MS. RAITT: Okay.

COMMISSIONER McALLISTER: -- to Heather. I think we're going to --

MS. RAITT: Any.

COMMISSIONER McALLISTER: -- wrap up.

MS. RAITT: I --

COMMISSIONER McALLISTER: Any other --

MS. RAITT: Any other comments in the room?

(No response.)

MS. RAITT: We don't have any questions on WebEx and nobody on the phone line, so I think we're --

COMMISSIONER McALLISTER: All right.

MS. RAITT: -- ready to wrap it up.

COMMISSIONER McALLISTER: Great. Well, thanks for -- thanks -- thank you to staff for all the great work. A lot of heavy-duty content in your presentations. (Laughter.) I really enjoyed it.

And any other comments, Commissioner Scott?

COMMISSIONER SCOTT: Yeah. I'll just -- I'll just add how much I appreciate your -- your all's appreciation and love for the data (laughter) and the thought and the care that you kind of put in to making sure that we have good data, that it's reconciled well, that it really does help feed and help us understand the demand forecast that we're trying to put together.

So, thank you very much for that.

COMMISSIONER McALLISTER: Let's -- so, did you give the deadlines for comments on this --

MS. RAITT: Not yet.

COMMISSIONER McALLISTER: -- particular topic, et cetera?

MS. RAITT: Not yet.

COMMISSIONER McALLISTER: Yeah.

MS. RAITT: No. Thanks, so.

COMMISSIONER McALLISTER: Oh, great. Here it is.

MS. RAITT: It's on the slide here. Requesting comments by April 2nd and here's the information about how to file comments and it's also on the public notice for this workshop.

COMMISSIONER McALLISTER: All right.

MS. RAITT: That's it.

COMMISSIONER McALLISTER: Terrific.

COMMISSIONER SCOTT: Thank you.

COMMISSIONER McALLISTER: Thanks, everybody.

(Whereupon, at 4:14 p.m., the workshop adjourned.)

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

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/s/ Rebecca Hudson

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