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BEFORE THE
CALIFORNIA ENERGY COMMISSION (CEC)

In the matter of,	
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2013 Integrated Energy Policy Report (2013 IEPR)	

Joint IEPR

Transportation Lead Commissioner Workshop

Transportation Energy Demand Forecasts

California Energy Commission
1516 Ninth Street, Hearing Room A
Sacramento, California

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10:05 A.M.

Reported by:

Kent Odell

APPEARANCES

Commissioners

Andrew McAllister, Commissioner

Robert Weisenmiller, Chairperson

Janea Scott, Commissioner

Staff

Suzanne Korosec

Heather Raitt, IEPR Lead

Aniss Bahreinian

Laura Graber

Gary Yowell

Gordon Schremp

Also Present (* Via WebEx)

Other Presenters

Tom Carlson, Sierra Research

Dean Taylor, Southern California Edison Company

Public Comment

Bob McBride

Robert Sawyer

*John Rozsa

Ryan Eggers

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P R O C E E D I N G S

AUGUST 21, 2013 10:05 A.M.

MS. RAITT: Good morning. Welcome to today's Joint IEPR and Transportation Workshop on Transportation Energy Demand Forecasts.

I'm Heather Raitt, the new lead for the IEPR. Suzanne Korosec has done an amazing job blazing the IEPR for the last six years and is now moving on to a new opportunity. She's leading the Energy Commission's newly created Renewable Energy Division.

Congratulations Suzanne.

Suzanne is a tough act to follow but we'll try to make the transition as smooth as possible and I look forward to working with all of you.

And with that I'll go over the usual housekeeping items before we get started.

Restrooms are in the atrium, at the double doors and to your left.

Please be aware that the glass exit doors near the restrooms are for staff, only, and will set off an alarm if you try to leave the building that way.

We have a snack room on the second floor, at the top of the atrium stairs, under the white awning. And for lunch we've provided a list of restaurants, within walking distance, out on the table with the other

handouts.

If there's an emergency and need to evacuate the building, please follow the staff to Roosevelt Park, which is across the street, diagonal to the building, and wait there until we're told it's safe to return.

Today's workshop is being broadcast through our WebEx conferencing system and parties should be aware that you are being recorded.

We'll post the radio recording on the -- the audio recording on the Energy Commission's website in a couple of days and a written transcript will be available in about three weeks.

We'll take questions from the dais after each presentation, but we are asking participants to hold your questions until the public comment period.

We will provide an opportunity for questions and comments before the break, before lunch, and also at the end of the day.

During both public comments periods we'll take comments first from those of you in the room, followed by people participating on WebEx and, finally, from those who are phone-in only.

When it's your turn to speak please come up to the center podium and speak into the microphone so the WebEx participants can hear you, and so we can

accurately capture your comments in the transcript.

It's also helpful if you can give the court reporter your business card so we can make sure to spell your name and affiliation correctly in the transcript.

For WebEx participants, you can use the chat function to tell our WebEx coordinator that you want to ask a question or make a comment during the public comment period. And we'll either relay your question or open your line for the appropriate time.

For phone-in only participants, we'll open your lines after we've taken comments from the in-person and WebEx participants.

Written comments on today's topics are due close of business September 6th. And the workshop notice, which is on the table with the handouts, and also posted on our website, explains the process for submitting written comments.

And now, briefly, a review of today's agenda, this morning staff will present the Statewide Transportation Energy Forecast for California.

Then Tom Carlson, from Sierra Research, will provide a presentation on vehicle attributes.

And Dean Taylor, from SCE, will discuss transportation electrification.

Then we'll break for lunch at about noon.

After lunch, staff presentations will provide a historical perspective on transportation fuels in California and update on energy supply and transportation needs.

And with that I'll turn it over to the Commissioners for opening remarks.

COMMISSIONER MC ALLISTER: There we go. Thanks very much, Heather. And I wanted to also congratulate Suzanne for her new role, which is I think very well deserved -- well, I know it is.

And it also makes a lot of sense just in the structure of the organization to have renewables be a stand-alone entity, particularly with the Renewable Portfolio Standard, all the new responsibilities we have there.

And also, just enable, you know, you to focus on building that staff and all the, certainly, existing and new responsibilities that division will have.

So, congratulations and thanks for all your hard work on the IEPR. And this year, obviously, very closely involved with you on that, but in previous years. I mean they've really built a great team and having a good succession plan is part of the responsibilities of a good leader and I think you've really done a great job on that.

And Heather, obviously, is capable of stepping in and taking the reins, and she'll figure that out. And so, welcome Heather and I really look forward to working with you more directly on this as we finish up the IEPR. "Finish up" the IEPR this year.

So, with that I want to just make a couple of brief comments. I've been looking forward to this workshop, again sharing the dais with Commissioner Scott, the lead on Transportation.

In a lot of ways transportation is one of the hardest, if not the hardest kind of area to figure out how we're going to meet our long-term climate goals in California.

We love our cars in California. But it's not just that, it's actually more than that. We have a large population that I think is growing, it's geographically disperse, we have a big area, we have a lot of -- we have a major economy and we have to get goods around the State.

We have, you know, the major ports on the West Coast and we have to get goods around, as well as people.

And as part of our forecast, you know, if you look at sort of the top issues that the Commission looks at around any given energy arena it's to conserve

resources, protect the environment, ensure reliability, enhance the State's economy, protect public health and safety. Obviously, air quality -- in the air quality arena California's long been a leader with our air districts and our Air Resources Board.

But there are many, many priorities that we have that really fundamentally relate to transportation and that we have to balance.

And, you know, there's really no getting around the fact that gasoline in particular, but fossil fuels, extractive fossil fuels are fantastic fuel sources. They are energy dense. You know, they're a hard-to-find-substitutes for. They really are fantastic stuff. Pull it out of the ground, refine it, and really all you have to do is fill up your tank every so often, change the oil every now and then and you're good to go. I mean it's pretty incredible, actually.

So, finding substitutes for those is a big challenge. Electrification is obviously front and center. The electric platforms are super important.

And California, frankly, is doing more than any other State, I think by a fair amount, but we still have a long, long way to go. We're still just at the very front end of this and it's not clear what the end game looks like.

So, this forecast is a really important step along the path, the long-term path for California to figure out what to do to get to the end result that we want.

And I'm stating what a lot of staff in the division already know, but I think it's good to get on the record and kind of frame this discussion, frame this workshop.

It's not all about electricity and natural gas. It is actually -- there are unique things about transportation. And we have to sort of step above the fray a little bit as transportation, as we talk about electrification and natural gas sort of overlapping now in the transportation sector in ways that I think are getting past the silos that we've had traditionally.

And so it makes it a much more rich conversation. But it also makes it a more complex and in some ways more difficult discussion.

So, I think staff is obviously capably grappling with all these issues and I look forward to seeing what the status is during the day, and taking the next steps in this IEPR and in the following IEPRs to figure out how we're going to chart the course for it.

So, thank you all again for coming, both those in the room and on the line.

And I'll pass it to Commissioner Scott for any comments you might have.

COMMISSIONER SCOTT: Good morning, everyone. I'm Commissioner Janea Scott. And I want to thank you all for attending today's Joint IEPR and Transportation Workshop.

I also want to echo my congratulations and thanks to Suzanne and my congratulations to Heather. We're very excited to work with -- I continue to be excited to work with both of you in your new roles. So, congratulations to you.

So, I'm the Lead Commissioners on Transportation issues here at the Commission. And, in particular, one of my focuses is the Alternative and Renewable Fuel, and Vehicle Technology Program.

And today's workshop is the third that we have held here on Transportation Energy Demand in California.

The first one that we did on June 26th was focused on the models, the methods, the assumptions that staff had proposed for developing their assessments and forecasts.

The second one that we did on July 31st featured input from industry experts from all across the country, and California, and also from other countries as well. Some folks called in from as far away as Brazil.

And these experts provided the Energy Commission with their best thoughts, their experiences, data, their expertise on what the future demand and growth scenarios for a variety of alternative fuels, and technologies and vehicles could look like between now and 2050.

And then today what we're going to do is have the staff present their draft forecasts, and supply demand balance of total transportation fuels in California throughout 2050.

And so I'm very much looking forward to this kind of preliminary snapshot that we're going to see today about how all this information is beginning to come together and take shape.

And I just want to say thanks to all of the staff and the stakeholders for participating over the course of these three workshops to help build this, and for joining in our discussion today.

So, I'm just looking forward to continued comments, continued feedback, and to getting going. So, thank you.

MS. RAITT: Okay, great. Our first speaker is Aniss Bahreinian.

MS. BAHREINIAN: Good morning Commissioners, stakeholders and staff. My name is Aniss Bahreinian and I'm here today to talk about our transportation energy

forecasts.

But at the first I just want to mention that I don't want to create the illusion that I did all of the numbers. The credit goes to all of the staff at the forecasting unit. Without any one of them these numbers would not have been generated.

So, the name of all of the forecasting unit staff is at the end, on the last slide, and they all get tremendous credit. I'm just putting it together only because I didn't go on vacation in the last three months. That's the only reason why I'm here.

But even those who were on vacation, I should say, were doing the work. Some from the Neptune Pool at Hearst Castle and others from a coffee shop on the college road trip to Pennsylvania. So, I mean they were working and without charging the State anything, I should say.

What I'm going to do is to start the conversation. Before starting the presentation, I also want to express my gratitude to a number of other folks outside the CEC, who have made all of this possible.

First and foremost I want to thank Brad Wagner, at Christensen Associates. He did a lot of help because we had a new model and the new model had to be recoded.

I also want to thank Phyllis Ansheck at the

Christensen Associates and Tim Jacob at Stanfield System, who has been in charge of the software that we are using in order to generate the forecast.

Moreover, I'd like to thank the staff at PHNEW Center at UC Davis. They helped us with information about the EV and PHEV vehicles.

And I also want to thank Carol Shellenberger and Gary Fuji at Office of Fleet and Asset Management. They provided us with data, with the VMT data that we used in order to generate forecast of fuel consumption for government, for vehicles.

I also want to thank Jonathan Cohen and Shelly Osborn, as well as Lou Browning at ICF International.

Jonathan Cohen worked on the models, estimating the models.

And Shelly did a lot of work with the survey and managed the project.

And Lou Browning generated the attribute values that we have used in the survey.

Of course, Sierra Research is here and they are the ones who have generated the attributes for our forecast and I want to differentiate these two from each other.

The Demand Forecasting Unit presentation is basically going to be, you know, what I'm presenting

here now. And Laura is going to talk about household travel, and Sierra Research is going to talk about the light duty vehicle attribute projections that we have used in our forecast.

There are a number of acronyms that we sometimes forget that nobody else knows about them, and we keep throwing them around. I just want to make it clear, some of these acronyms.

We use LVV, to stand for light duty vehicles. HDV is heavy duty vehicles. VMT, we frequently use that, that's vehicle miles traveled. MPG is the miles per gallon. HSR is high speed rail. And HSRA is high speed rail authority. DMV is the Department of Motor Vehicles. NEV is neighborhood electric vehicles. FCV is fuel cell vehicles hydrogen. And BEV is the battery electric vehicle. And FFV is flex-fuel vehicles.

So, if we use these acronyms, this is what we mean by them.

So, what is it that we forecast? We forecast transportation energy demand by fuel type. We want to make it clear that the transportation energy demand that we are forecasting is only what is used from tank to wheel. And we want to mention that. So, that's the only portion.

Therefore, in the case of high-speed rail, they

have generated forecast of energy consumption both for what they call traction, as well as total energy. And we just want to make it clear that for our purpose, for our models we have to compare apples to apples and we use traction energy.

Although the numbers that you're going to see in the forecast include other electricity use at high-speed rail, but that is not what is going to be in the final forecast because we mistakenly got it into that forecast.

The natural gas we are referring to both CNG and LNG. And when you're combining all of that, as we are going to see later, we have a number of new CNG vehicles. So, the natural gas, the total natural gas consumption is going to include consumption for all of these.

Also, when it comes to hydrogen we are going to use -- we are going to forecast what is used in transportation, moving people or goods from one point to another point. That's the only portion of hydrogen that we are forecasting.

Our forecast is also statewide and the forecast relied on for us is from 2011 to 2050. Of course, we are past 2011 and 2012, so what matters is 2013 to 2050. But our model starts with the base year of 2011.

Demand Forecasting Unit used a number of economic models. They are mostly choice-based and they account for the impact of time and/or cost of an activity or product, as well as income and/or economic output in the travel mode and vehicle choice process. So, we account for those factors.

I should also mention here and that's I think is important is that our models, some of our models, particularly the household or residential light duty vehicle model is a dual-use model.

And by that what we mean is we are using it for forecasting but it also has a lot of design elements that enables us to do policy analysis.

For instance, if we are telling you that, well, our forecast is going to incorporate all of the incentives and it's going to apply them to an entire forecast period, if somebody doesn't like we could generate the forecast without them. And so we could compare what the forecast is going to be with and what the forecast is going to be without.

These models forecast light duty vehicle transportation energy demand for personal travel, for commercial travel, for heavy duty vehicles in movement of goods, as well as in movement of services. And we are separating these two from each other.

We also forecast heavy duty vehicle transportation energy use in intercity and urban transit.

Our aviation model forecasts fuel demand for inter -- intrastate, what goes on in California, interstate, that is how we are flying to other states in the U.S., and international. So, we are separating between these three different market segments.

We also have a freight aviation that is used for projecting jet fuel demand for movement of goods.

We should say, however, that in this bullet I'm saying aviation fuel demand we are using it for personal and business travel. I should say that the model is designed that way. However, we have not found credible data to differentiate between business and personal travel. And, therefore, we have combined it.

So, our forecast does not differentiate between personal and business travel but the model is designed so that if at any point we come to some kind of data that we can use, then we are going to make a change and change the forecast so that we can differentiate between business travel versus personal travel.

The key inputs in this model are, of course, first of all I mean the thing that runs through it is like a thread that runs through the whole thing because

we are Energy Commission, it's a transportation energy prices. That variable runs through the entire model system.

We have income and economic growth. We have sectorial distribution of GSP. This is more important for some models than others.

We have national and international economic growth because we have that international aviation, so we have to differentiate between national, international and California growth.

We have household and population growth, we use those.

We have projections of fuel economy by fuel type and vehicle class. And we have projections of vehicle LDV, vehicle prices and other attributes by fuel type and vehicle class.

These, too, are coming from Sierra Research.

We have household preferences for the vehicle ownership. That comes from our survey.

We have household and commercial consumer preferences for different LDV and fuel types, for different classes, and size, and fuel types. And this one also comes from our survey and we hold it constant over the entire forecast period.

We have also consumer preferences for travel and

travel models. And we need to mention here that these are from other surveys and other studies, not from something that California Energy has conducted. And they have been developed by different people, different group of people.

However, in the future we have a plan to create a brand-new model for ourselves based on California Household Travel Survey in combination with our own Vehicle Survey.

Travel time and cost by different modes is an input into the model. And the current stock of California vehicles, of course, is starting our forecast in 2011. So, our 2011 base year data completely comes, is based on DMV stock of vehicles in that year.

What is new in 2012 forecast? Well, we have a new fuel type. That's hydrogen, we didn't have that before.

We have new vehicle technologies that is diesel hybrid, CNG hybrid, CNG bi-fuel and FCV.

We have separate LDV fleet size forecasts for government, rental and neighborhood electric vehicle.

In the past we have integrated those with everything else. And as we are going to go through these slides you're going to see that while it is not that important, but there are distinct differences

between them.

I should say that many other agencies and forecasters, they combine everything and they generate one forecast for everything.

But as you will see through the slides there are distinct differences between these sectors.

We have a new aviation market segment. We have international. International was present in our past forecast, but thanks to Jesse Gage we have perfected it in a way that it can be used in a reliable manner.

We also have a new travel mode, because the Commission has asked us to do that, and that is high-speed rail.

When it comes to the high-speed rail we should say, and we did say in the June 26th workshop that our models currently do not accommodate high-speed rail.

Therefore, we were forced to go outside the models and post-process the forecast.

We have examined the impact of high-speed rail on other modes after our models generated a forecast. So, we first developed our own forecast of urban and intercity travel, then we used high-speed rail and we adjust our own travel to reflect the mode share diversions that are specific in high-speed rail forecast.

We use the conservative projected ridership and fares as outlined in HSR's revised 2012 business plan. So, that is the projection that we have used.

High-speed rail projections include high, low and mid case projections.

As you can see in the next slide, if you compare the scenarios in high-speed rail study, in their projections, with our scenarios, the way they are defined if you look at, for instance, liquid fuel prices, income and population, we are not -- the High-Speed Rail Authority's scenario definitions do not match any one of ours.

And, therefore, because of that we only focused on the mid case scenario. So, the only forecast, the only scenario that you are going to see high-speed rail is in the reference scenario. So, we used their mid case scenario projections and then we applied that to our reference scenario.

We probably can do the other ones if we have enough time, but only if we use the same scenario definitions as they do, and then import that.

I should also say that we have done two scenarios, one scenario with HSR and another scenario without HSR. And the reason for that is we want to see what the impact of high-speed rail is going to be on

different fuel consumption in California.

Our high-speed rail analysis takes total ridership from, right from projections by high-speed rail. So, we make the assumption that those are correct and we just import them into our post-processing.

High-Speed Rail Authority projected mode diversion rates were used to reduce travel by other modes. So, not only do they project ridership, but they also project how much of that ridership is coming from different modes.

For instance, they could say, as one example, this is not the real number so please don't quite it. I'm just giving an example. If they say that we are taking away 50 percent from air, then that is what we are going to use. We are going to reduce our air travel by 50 percent.

Not all of the air travel and I'm going to go on and talk about it later.

The assumptions that we are going to make is high-speed rail will begin and continue operation on schedule. High-speed rail induced travel, ridership and mode diversion rates will hold as projected, because we're using their numbers.

High-speed rail fares will be set at 83 percent of airfare. High-speed rail was offered in our models

as a mode only for long distance intercity travel.

So, we have two models, one that is generating transportation energy in the urban areas and another one that is going interregional. So, we only allowed, naturally, high-speed rail compared -- or compete with our intercity modes, not with our urban modes.

I should also add that initially we were going to use a 100-mile threshold to differentiate between urban and intercity travel, but after looking at some of the stops along the routes of high-speed rail, then we decided to use another threshold, the 50-mile threshold. Because some of those stops, particularly in the Bay Area, are pretty close to each other, in order to increase the number of trips that would be competing with high-speed rail.

What are the implications? Now, high-speed rail only affected the transportation energy demand for intra-California air travel. So, that is important.

Remember that we have three segments, intra-California, interstate and international when it comes to air travel.

High-speed rail only competed with the intra-California portion of air travel. And as you can see later, you would see that there are distinct differences between the fuel consumption in these areas.

Actually, the assumptions are at the heart of our study here. We want to clarify here that for the survey, for the hypothetical vehicle choices that we offer to our participants, we included all of the vehicle classes in all of the fuel types. So, that's what we did in our survey.

However, when it comes to our attribute projections that we used in forecast, this was not the case. We did not include all of the different vehicle classes for all of the different fuel types, and certainly not in all of the years.

I should say here that the only light duty vehicle attribute that changes with fuel prices and income at the present time, according to our attributes, is the number of makes and models.

Other attributes are remaining the same. What are these other attributes? These other attributes are range, vehicle price, trunk space, fuel economy, maintenance cost, fuel station availability, and a number of other factors that we have hold constant -- or not holding constant. But what I'm saying is it's only we have only one scenario for it. So, regardless of whatever you're using, high, low or reference, for those attributes we have the same numbers. We used the same numbers.

The only thing that varies is the number of makes and models within a class of vehicle.

In this -- in the previous IEPRs we also have used on-road MPG. This is different from what is generated in the lab. In the labs they could generate a higher MPG value, miles per gallon. But in our forecast in the past we have used on-road MPG. And this time around we are also using on-road MPG.

The difference is that the discount rate that was used in the previous IEPRs was spread the same across the different vehicle types.

For instance, if there was a discount rate of 20 percent for the on-road -- for lab MPG in order to use the -- in order to derive the on-road MPG it was applied to everything whether it was -- whether it was EV, or hybrid, or gasoline, or diesel, et cetera.

This time around there are differentiations between these rates and Sierra Research can explain that.

It is important to use on-road MPG, however, because the actual conditions of the road are not allowing these vehicles to reach their maximum. And so we need to use the on-road MPG rather than what is generated in the lab.

Light duty vehicle technologies will be

introduced and commercialized according to the projected technology introduction schedule. So, all of these different technologies are not introduced all at the same time. They're introduced at different times. Between now and 2050 some do not get introduced at all, so we need to make that clear.

Also, among our attributes we have maintenance, but we do not have repair cost. Repair cost is a very important part of your decision making if you're particularly buying a used vehicle, for instance. We do not have that.

And so, we are making the assumption that whatever preferences you have for that is going to be reflected in the values that you are coming up with in 2011.

We also do not have insurance and loan rates. We know that a lot of vehicles are being purchased using loans. So, the fact of the matter is that interest rates should apply. A lot of the vehicles are being leased, so the lease rates should be applied.

And, actually, a lot of the new vehicles, like EVs, are offered at a lower lease rate than normally is expected.

And so at one point what we did is we asked Sierra Research to come up with the lease equivalent

price, which is much lower than the prices that we have used in our attributes. But we did not end up using it because we wanted them to feel comfortable with the attributes that they are projecting and because it is not going to last forever. The low lease rates are not necessarily going to last forever.

We also have used EIA heavy duty MPG projections and fuel types. And we are making the assumption that EIA MPGs are reflecting of what goes on in -- on California roads. So, this is implicitly we're making that assumption.

We have also used EIA-projected aircraft fuel economy improvements and we are making the assumption, and I think this is a better assumption because in the airline industry you really don't have much differentiation between California versus the rest of the nation when it comes to fuel economy.

So, what are our forecasting assumptions? We keep loading you up with all of these assumptions and it is only an attempt to be transparent about what we are doing so there is no misunderstanding anywhere.

We have used average VMT. That is the same for all household cars regardless of the fuel type. So, everybody is driving the same number of miles.

FFV owners, that is ethanol car owners, on

average fuel their vehicles 50 percent of the miles with gasoline and 50 percent with E-85. That's our assumption. We have to make these assumptions because we do not have a fuel choice model.

So, if anybody doesn't like the 50/50 divide between ethanol and gasoline, we can run the model making a different assumption.

Gary Yowell is going to talk about the realities of today's ethanol fueling. But for all forecasts we have made this assumption.

If at the end anybody has any recommendation to change these ratios, let's say from 50 percent to 25 percent, or from 50 percent to 100 percent, then we can do that. It's easy to run those models.

CNG dual fuel owners on average fuel their vehicles with CNG for 50 percent of the miles and 50 percent with gasoline. So, we had to use this divide of 50/50 for everything.

PHEV owners drive 50 percent of the miles on electricity and 50 percent on gasoline. That's also another fuel choice assumption that we have made.

We should say that PHEV Center told us about one of their studies that showed actually for the PHEV-10, which is hybrid PHEV -- I'm sorry, Prius PHEV, the numbers showed 20 percent in E miles. But for Volt, the

50 percent is going to be more accurate.

However, when you put it in the long-term context of our forecast, 50 percent is not really that bad. It's reasonable because these vehicles eventually are going to have to reach that.

Plus, our model does not differentiate between manufacturers. So, we have one class of vehicle. We have one fuel type, one class of vehicle. We do not differentiate between manufacturers and, therefore, we could not automatically apply that in our models?

COMMISSIONER MC ALLISTER: Yes, can I ask a quick question here?

MS. BAHREINIAN: Sure.

COMMISSIONER MC ALLISTER: So, does the model have the ability to tweak that percentage year to year or period to period? So, if you make some assumptions about the evolution of the technology --

MS. BAHREINIAN: We can do that, yes.

COMMISSIONER MC ALLISTER: -- and batteries, and kind of the percentage presumably would go up over time?

MS. BAHREINIAN: Yes, we can do that.

COMMISSIONER MC ALLISTER: Okay, great.

MS. BAHREINIAN: Another important set of assumptions is regarding the fleet mix. We have made no assumption about the fleet mix in personal and

commercial light duty vehicles.

But when it comes to rental fleet mix we have made the assumption that they are held constant at their 2012 levels. In other words if, say, 50 percent of the rental vehicles were gasoline, we just made the assumption that over the entire forecast period it's going to be gasoline.

When it comes to government fleet we did something -- well, first of all, these two are really brand-new models that we have been using.

When it comes to government fleet and we talked with -- after talking with Office of Fleet and Asset Management, they told us that their policy is to retire vehicles after 10 years or 120,000 miles.

We couldn't possibly use the 120,000 miles threshold, but we did use the 10-year criteria.

And so what we did, we retired all of the vehicles, all of the government vehicles at the age of 11. And what we did, we forced government to purchase new vehicles to replace them.

Then when they bought the new vehicles, we made them to comply with the ZEV mandate. So, the only place when the ZEV mandate has been enforced is in government fleet.

We intended to force that only to the State

government fleet but currently it is being applied to all government. Remember that we also include local government fleet in this category, too.

But in the final forecast we are only going to do that for the State government fleet.

And as you're going to see later, these numbers are not really that big and so they are not going to make a whole bunch of difference.

So, what we are doing this time, we are building different models for different market segments. And why do we do that; because different sectors have different vehicle needs and different behavior.

Lumping them together can over- or under-estimate vehicles or fuel consumption.

Vehicle price is a large share of household income and vehicle usage for the households competes with other modes of travel, like bus, light rail, aviation, et cetera.

Vehicles are used to meet business needs and more sensitive to changes in economic activity. So, the commercial light duty vehicle sector is more responsive to the changes in the level of economic activity, naturally. If people are going out of business, they are not going to buy as many vehicles. We are going to lose vehicles.

Government vehicles are used to meet the needs of the general population and are more responsive to mandates and policies. So, there has been, for instance, an Executive Order back in 2009 by Governor Schwarzenegger that was asking the State government to reduce their fleet sizes.

And if you actually look at the total number of fleet, State fleet or government fleet, as a ratio of -- or per 1,000 people we could see, for instance, that up to 2009 or 2010 it was 8 point something, but after that it has been reduced to 7, around 7. So, they are subject to all these different rules and regulations, so lumping them with everybody else is not necessarily a good idea, except that it is only 1 percent of the total vehicles.

Rental cars serve the needs of all market segments, including the zero vehicle households. Tourists and long-distance travel, a lot of people are using rental cars when they are going long distance. People who don't have any cars, they use rental cars. Tourists are using that.

So, the needs of this sector are different from others.

Neighborhood electric vehicles are used for low-speed and limited business movements on city streets,

and communities, and private establishments. They are used on golf courses for instance, in retirement communities. You see them on the streets. They give me a ticket all the time, the parking enforcement. So, you see them everywhere.

In our conversations, actually, and it would be erroneous to lump neighborhood electric vehicles with all the other electric vehicles because they have different mileage, and they have different usages, and different MPG for that matter.

So, where are some data that is going to support why we are differentiating between these markets. All of this data, I didn't put the source here, but this is based on staff analysis of the DMV data.

I should also say, by the way mid-course, is that we are always improving the quality of our data and model. So, we are always in the continuous quality improvement phase. Always try to improve things and Ryan Eggers makes improvement in his data almost on a daily basis. And our data is pretty strong, actually.

This is a 20 -- when you're reading it, please read each column, okay. What you see for instance in the household, at the bottom you see 100 percent. That is the distribution of the vehicles by class in the household sector. So, it is important to read each

column.

Now, if you look at these numbers you will see, for instance, that the highest percentage of LDV fleet, if you look at the total percent, you will see that the highest percentage of the fleet is in the midsize, 18.7 percent.

If you look at the total percent and you look at the highlighted area, yellow highlighted area you will see that 18.7 percent of the vehicles in California are midsize. So, this is maybe something that the manufacturers could listen to.

When it comes to the household sector and the range for the household sector is 19.3 percent. That means that 19.3 percent of the vehicles in the residential or household sector is midsize.

When it comes to commercial sector, again going along the yellow highlighted area, you will see the figure 15.1 percent on the third line. That is the percentage of vehicles in the commercial sector that are midsize.

When you go to government, government percentage, GOV, you would see that the percentage, look at the green-colored area, right, and look right across from large cars. You would see that 19.1 percent of the vehicles in government possession are full size.

I should add, also, that the data that we obtained from OFAM, Office of Fleet and Asset Management, showed also that the highest number of vehicle miles are in that category. So, it is the full size cars that are driving the most, around 28,000 miles a year.

Right below the 19.1 percent you would see the .1 percent. While we just hope that government is not really buying a lot of sports cars and it shows that is the lowest percentage, right? It complies with -- it's .1 percent of government vehicles are sports vehicles.

Moving on to the next column, we would see for instance that, again, even for the rental cars 28.5 percent of all rental cars are midsize vehicles. Okay, that is the highest percentage -- well, comparing, rental cars are only .5 percent of the vehicles, but among those vehicles 28.5 percent of them are midsize.

What that means is that a lot of people want to drive their rental cars should be midsize. They know what the consumers want and that's what they are going to give to the consumers.

If you look at, for instance, when it comes to the rental cars, at the same time comparing with household, commercial and government you would see that rental car fleet includes the highest percentage of

within their own, within that 5 percent, 23.8 percent of them are also compact cars. So, they have a lot of compact cars and a lot of midsize cars.

Moving down the line for the rentals, you would see that cross-utility they also have, compared to other sectors, the highest percentage of their fleet -- their fleet, that is the rental fleet is -- compared to other sectors is 10.9 percent. Compare that to 1.8 percent for government. So, government is not really using a lot of these sport vehicles or cross-utility, sorry.

If you look at the government sector, go across the pickup standard, and you will see that government fleet has the highest percentage of standard pickup trucks, 15.2 percent.

And when it comes to commercial, right next column to the left, you would see that 17.3 percent of commercial fleet is pickup, but in the weight category of 8,500 to 10,000.

So, you could see here, from this table you could clearly see there are distinct differences between these sectors. Lumping them all together and making assumptions could lead to a lot of errors.

If I turn the page, this is also a 2012 data. Based on Ryan Eggers analysis of DMV data you would see 2012 distribution of fuel types by market segment.

Again, please pay attention to the 100 percent at the bottom of each column, right.

So, we are looking at total number of gasoline vehicles. And of the total number of gasoline vehicles, 86.4 percent are in the household sector, are personal.

Of the diesel vehicles, look under the column with diesel, you will see that 78.8 percent of diesel vehicles, of diesel vehicles reside in commercial sector, commercial light duty sector.

When it comes to electric vehicles, right next column, to the right, you will see again that the commercial sector has the highest percentage of electric vehicles. So, contrary to common belief, it seems like the commercial sector actually has a lot of preferences for different types of fuel, and this also shows in our survey.

When it comes to hybrid, right next column, you will see that 79.42 percent of all hybrid vehicles reside in household or residential sector.

And when it comes to PHEV, again the commercial sector has the highest percentage, 57.36 percent of the PHEVs are in the commercial sector.

When it comes to natural gas vehicles, CNG vehicle actually, I should say, 44.5 percent of the CNG vehicles are in the personal or household sector. Sorry

for the mislabeling here or inconsistent.

Notice when it comes to -- if you look at the government row, under electric, you will see that 21 percent of electric vehicles are in the government sector.

You would also see that, if you look under FFV, ethanol vehicles, 4.3 percent of FFVs are in the government sector. 69.3 percent of them are in the household or residential sector.

So, household takes the lead when it comes to FFVs and gasoline, and hybrid and natural gas.

Commercial sector takes the lead when it comes to diesel, and electric, and PHV, interestingly enough.

COMMISSIONER SCOTT: Aniss?

MS. BAHREINIAN: Yes?

COMMISSIONER SCOTT: When you look at the distribution here is this the same set of vehicles that you had presented on the slide previous, which were the cars, the cross, the sports, the vans, or this is a broader set?

MS. BAHREINIAN: The same kind of, yes.

COMMISSIONER SCOTT: Okay, so like the electric, for example in commercial, doesn't include forklifts or things like that?

MS. BAHREINIAN: No, no, no, no.

COMMISSIONER SCOTT: Okay.

MS. BAHREINIAN: No, they do not include forklifts, no, not at all. Thank you.

COMMISSIONER MC ALLISTER: So, that's kind of a surprising number that 41.7 percent of electrics are in the commercial sector. Do you have any sort of further, deeper understanding of what kinds of vehicles those are? Is that just companies that have them parked at their office and people use them during the day, or is that number sort of --

MS. BAHREINIAN: We don't have --

COMMISSIONER MC ALLISTER: -- is that true commercial or is that some kind of utility vehicle or what?

MS. BAHREINIAN: We don't have the -- a true picture of who is doing what, we don't have that.

But one thing that we have gained from our survey is that, as I said, interestingly enough it seems like commercial sector is actually more open-minded with respect to the fuel type.

So, it shows even in the responses of the participants in the survey that they are willing to try other things. Even in the focus group study that we did, we had commercial participants. And our commercial sector participants were telling us, well, if it is

going to cost us less, we are going to use it. So, they don't have a closed mind to fuel types.

But as you could see in the previous one -- well, as you can also see here, diesel is a prominent share of commercial, 78 percent is actually commercial light duty vehicles.

But do we have a better understanding? Not yet. One of the things that we wanted to do at some point was to try to -- like we have California Household Travel Survey. We wanted to do something for commercial light duty sector. We have not been able to do that, yet. We want to work with Caltrans on that project, yet. And of course it's the issue of funding and all the other, you know, issues that will be there. But that is going to shed some light on their behavior.

COMMISSIONER MC ALLISTER: Yeah, I mean, like the government electric you can see, you know, over in the parking lot over here there's DGS and they've got a row of Leafs there that they use for certain types of travel that they do. And, you know, sort of I kind of understand that sector and that's a market leader, and that's also making a choice that serves their needs.

But I was just surprised to see the 40, almost 42 percent there for commercial. I'm just trying to get my head around what those are.

MS. BAHREINIAN: Yeah.

COMMISSIONER MC ALLISTER: You know, well, I mean I can imagine a few scenarios. But it would be great, I agree with you, I'd be very supportive of digging into that a little bit.

MS. BAHREINIAN: Yes.

COMMISSIONER MC ALLISTER: Because if that's truly the largest market segment for electric vehicles, then that's a key leading edge thing that we need to understand in order to push it further and get the most out of that for demonstration purposes, for market understand and, et cetera.

MS. BAHREINIAN: Well, it's also the case that it could be that they are willing to more experiment with things. And as soon as some kind of technology gets established then the household sector is going to follow because some of those businesses also have their own cars.

COMMISSIONER MC ALLISTER: Thank you.

MS. BAHREINIAN: So, in the next one, again along the line of why we shouldn't mix things together or lump everything together. Again, this data is also based on Ryan Eggers 2012 analysis of the DMV data.

This is the 2012 LDV vehicle age distribution. So, this is light duty vehicle age distribution.

If you look at this, then you can see that yellow line very clearly. That yellow line, which is going to the sky, to 60 percent, that is our rental fleet. Again, they're only .5 percent of the vehicles, but it is clear that the rental vehicles turn over within three years at the most. They turn over within three years.

They buy a vehicle and I think based on some of the stuff that I have read and heard, they have 24-month contract with the manufacturers or something like that, so it's even less than that.

If you look at the same graph, if you look at the blue line, the blue line is the commercial. You can see that commercial sector is the next sector. First of all, rental sector is the one that has the newest vehicles. And on the newest vehicles they put the maximum number of miles.

So, if they have 2013 vehicles or 2014 vehicles, they are putting the most miles on those brand-new vehicles. Because when you and I go and rent a car, we want a new car, right, and they provide that to us.

If you look at the blue line, that is our commercial light duty sector. That is what they use to conduct business.

And as you can see here, the number of new

vehicles in this sector is the second highest. So, the businesses also want to buy new vehicles because they can't afford to repair things.

As you can see here, it is peaking at the age of one. So, a lot of businesses are also buying new vehicles and perhaps that is one reason that can explain the EVs and the PHEVs there.

When it comes to government, government has the least number of new vehicles. Who can blame them because we are -- because of the budget situation, right, government is much more limited than all the other sectors. So, it is not surprising to see that.

When it comes to the household sector, personal, which is the red one, you can see here that, well, they also buy new vehicles.

But if you look at the line after eight, after the age of eight, et cetera, you can see that the distribution is actually higher than that. That means that the household sector has a higher share of the used vehicles.

So, whatever is in the rental sector, at the age of three when they get rid of it, that's a used vehicle, right, it goes and gets added to personal vehicles.

Whatever is in the commercial sector and it gets dumped after, say, five years, then it goes into the

used vehicle market and it gets added to the personal.

COMMISSIONER MC ALLISTER: So, we were just talking about that up here. I think that explains, that potentially explains a lot.

So, I guess, I wonder if you could work with, you know, a Car Fax, or CarMax, or one of these companies that is in the used car market to see about extended use of some of these vehicles when they actually do settle in the long-term sector where they're going to be for most of their lives.

MS. BAHREINIAN: And some of the oldest vehicles are also being exported to places like Mexico and other places. So, there are a number of factors that are moving on here.

One of the weaknesses that we have is that, I mean in general we don't have a vehicle supply model to begin with. But more importantly, we don't have a used vehicle market.

If we had a used vehicle market, it would have helped us determine the prices for the used vehicles and that is something that we will need sometime in the future.

So, these are the reasons why we have all these different models. So, how do we go about them?

We look at the largest share of the market,

which is residential. Our most elaborate model, so we pay more attention to the things that matter most, so we invest most of our money for the household sector, most of our time for the household sector. It is the most complex model and the most elaborate one because it has 84.5 percent of the vehicles.

If we make a little mistake there, it's going to add up to a lot of fuels.

Followed by that is the commercial sector. We have a vehicle choice equation in the commercial sector but we grow the number of vehicles by -- we grow the fleet size by the state of the economy. So, as GSP grows, the numbers of vehicles in that sector are also going to grow.

These are choices, both the commercial and residential sector. Light duty vehicle models are choice based. They're behavioral. They're economic and they're behavioral. They reflect the behavior of the households and businesses.

But when it comes to the other three sectors, government fleet, rental fleet and neighborhood, which are our brand-new models, we call them growth model.

Because what we do, we basically take the stock in 2012 and we grow them by different -- by the population different scenarios.

In this case you can see that government fleet is only .9 percent of total vehicles in the State. That's almost 1 percent. Rental fleet is half of one percent. And neighborhood electric vehicles are .05 percent of the vehicles.

So, what are the new light duty vehicle choice models telling us? They are telling us that households still prefer gasoline to all other fuel types.

So, if I want to just focus on the preferences of the households, just by the fuel type, then they definitely prefer gasoline to all other fuel types.

They also prefer larger vehicles to compact and subcompact vehicles. So, when it comes to all the different classes, they prefer those to compact and subcompact. For them, midsize car and small SUVs are on top of their favorite list. So, again, that's something for manufacturers.

Their preferences for AFV, which is alternative fuel vehicles, grows with the number of vehicles in the household. So, the more vehicles you have in the household, the more willing you are to risk on the alternative fuel vehicle. So, if you have three-plus vehicle households, the more three-plus vehicle households you have the more likely it is that we are going to have alternative fuel vehicles in the

household.

Three-plus vehicle households have a strong preference for hybrid and PHEVs. And considering diesel and diesel HEVs, the same as gasoline statistically speaking, and that means that the difference between the two is statistically insignificant.

Commercial fleet owners, they're statistically indifferent between all fuel types and gasoline. That means we show that they have a negative preference, but not really anything that could be counted as significant, statistically.

But they prefer flex-fueled vehicles to everything else. They prefer flex-fuel vehicles. They only thing that is an exception is the flex-fuel vehicles. They prefer that to gasoline and all other fuel types.

They also prefer all vehicle classes to compact and subcompact. So, like the household sector they prefer larger vehicles to compact and subcompact.

COMMISSIONER MC ALLISTER: Any idea why they prefer flex-fuel vehicles? Do they get some kind of price break or, you know, do the manufacturers work with fleet owners to get a lot of flex-fuel vehicles out in the market through that channel so they can meet their regulatory requirements, or what's your understanding of

that?

MS. BAHREINIAN: I think that it might be that some of these vehicles that they are using are offered in both classes, both FFVs and gasoline.

COMMISSIONER MC ALLISTER: Uh-hum.

MS. BAHREINIAN: But another thing that I think, and I'm not ready to make that conclusion yet, is that I think that what they need is more flexibility. Flex-fuel vehicle, PHEVs offer the flexibility for their business.

You don't want to be caught someplace. If there's not a fueling station for you to fuel up your vehicle, you want to have that flexibility and I think that that's one of the reasons. But we can tell you more at the end of the survey.

COMMISSIONER MC ALLISTER: Yeah, thanks.

MS. BAHREINIAN: Commercial fleet owners also prefer all vehicle classes to compact and subcompact, but they have a strong preference for standard and small pickup trucks. So, you would see a lot of standard and small pickup trucks there.

So, survey findings of relevance. ZEV mandate, zero emission vehicle mandate requires manufacturers to offer and sell ZEV vehicles. We all know that.

This is typically reflected in the increase in

the number of makes and models. So, the manufacturers are required to just produce more ZEV, according to California's ZEV mandate.

What we observed in the survey is that respondents less frequently change their mind with respect to the vehicle type that they plan to buy, I should say vehicle class, than the fuel type of the vehicle they plan to buy.

If they want a minivan, then they want a minivan. Don't give them anything else. If they want a midsize car, give them a midsize car. Don't mess around with the consumers. They want to stick to the vehicle class that they have selected.

They have more flexibility when it comes to fuel type. So, what does this mean? This means that if this is true, and I don't know that yet, but if this holds true that means that future mandates -- or policy implication is that if the goal is to increase sales of alternative fuel vehicles, then it is not enough just to increase the number of makes and models in a vehicle class. You have to increase the number of classes offered within the same fuel type.

Because if people want a large truck, if you give them an EV, an electric vehicle that is a large truck they may buy it.

But if they want large truck, they wouldn't necessarily settle for a compact vehicle. So, we need to know that.

Commercial fleet owners, another observation that we had, and this is not complete yet, so I just don't go too fast on this, is that they did not choose hydrogen as the vehicle they planned to purchase.

So, initially we asked them, in the survey we asked them what kind of vehicle do you want to buy? And they may tell us that, okay, I want to buy a gasoline vehicle, or I want to buy XY&Z.

None of them said they want to buy a hydrogen, all right.

But when it came to the stated preferences survey we offered them hydrogen. So, if you just tell them that, well, what fuel type do you want, they wouldn't include hydrogen.

But when we gave them the attributes of a vehicle, of hydrogen vehicles, some of them chose to buy a hydrogen vehicle.

That means that with more information then they may be able to buy some of these new vehicles. If you just tell them do you want an EV or do you want a hydrogen, they may give you an answer.

But if you define that EV and hydrogen in terms

of its attribute, then the story could be very different.

Tell them for instance that the fuel economy is better, range is this, performance is this, trunk space is this then they can make more selection, better selections.

Future according to our forecast, this is our jet fuel demand. And as you can see here, this is for the low, high and reference cases and you can see that the jet fuel demand keeps growing. We have the population and income will grow jet fuel demand.

If you go to the next page and this is important, particularly when you are comparing to HSR, if you look at the green line at the top that is your interstate air travel. That's jet fuel consumed for that purpose. You could see that it has the highest percentage of the jet fuel consumption.

If you go to the second line, the brown, you would see that that is the international. That is the jet fuel consumed for international travel which is also very high, just below the interstate travel fuel consumption. Considering that there are far fewer international -- well, I shouldn't say far fewer because California is on the border and a lot of people are flying out of California.

But considering the number of interstate travel, then you can imagine that fuel consumption for international is quite high.

And for good reason because once a plane is fueling at the airport, say, in San Francisco or in L.A., to go right across the globe they have to put a lot of fuel in those planes. That's why the consumption is so high for international.

And the purple line is what we are using for freight. And as you can see that also grows with economic activity.

And in the very bottom, the blue line at the bottom is intrastate. That is the fuel consumption for traffic from one location in California to another location in California. This is the only thing that is competing with high-speed rail.

The other modes are not competing with high-speed rail.

And, therefore, high-speed rail will only impact the intrastate aviation travel.

If you go to the next line you will see, for instance, aviation and high-speed rail trips. Because we have high-speed rail, you can see that a share of these trips have now gone to high-speed rail. A share of these air travel has gone to high-speed rail, 17

percent of it. 16 percent is still with aviation intrastate. And the two of them combined are almost -- well, they have equal almost.

International air travel is only 14 percent, only 14 percent of total trips, but you saw how much fuel it consumed. Again, because of the number of gallons that have to be loaded into this international travel.

Again, it's important for people to differentiate for any conclusions about what is going to happen to the jet fuel. It's important for us to differentiate between these market segments. They have different behavior, subject to different growth rates.

The international is more subject to the growth in the international markets as opposed to interstate versus intrastate.

Future according to our forecast with regards to fleet size, this is light duty vehicle fleet size. We have combined only personal and commercial vehicle stock, for no particular reason we just are showing this one. Otherwise we could add government, rental and everything else.

And this is from 2011 to 2050. As you can see in the low, reference and high demand cases, you can see that they are all growing and they're growing more or

less in response to population growth or income growth. That's how they are growing.

So, it is important to know that fleet size grows with demographic and economic factor, and economic growth; fleet size, the size of the fleet.

Move to the next one you will see a different story. This is the fleet mix. This is the percentage of different fuel types in the entire fleet.

As you can see here, the portion in the middle that is our gasoline fleet. And as you can see, the number of gasoline fleet is shrinking in the 2014 to 2050 time period.

You can also follow the colors on the legend and you are going to see PHEV on the top, natural gas is the next one, and that is your CNG, actually. Hydrogen is the green one. Hybrid is the brown one. Gasoline is blue. Electric is also blue. FFVs are the orange.

CNG bi-fuel, diesel electric hybrid, these are some of the fuels that we are including for the very first time.

Diesel and of course CNG hybrid which is another new technology that we are incorporating here.

So, if you really want to look at the natural gas consumption, you are going to have to add up CNG hybrid, CNG bi-fuel, and natural gas, which should have

been CNG, actually.

That's the fleet mix. Let me also mention here, because that's quite important, actually, the fleet mix only changes with the attributes, with the vehicle attributes. It does not necessarily change all that much with population and economic growth.

It grows with -- it changes with the attributes. And if I look at different cases that we have, because we are using the same set of -- almost the same set of attributes between the three cases, you don't see too much deviation in the fleet mix for the three reference cases. But you did see some differentiation in the fleet size.

So what do we have here? This is our transportation energy demand by fuel type. So, the red line that I have colored it in red so everybody can see, that's gasoline. It's going down. Gasoline consumption is going down.

If you look at the very bottom we have propane, which is a very small portion of the fuel. But also you can see the blue line -- sorry, the brown one, hydrogen, it is a smaller growing -- it's gradually growing over this time period. Not a very high rate of growth but it is growing over this time period.

Jet fuel is of course jet fuel, we have already

talked about that.

And you also see E-85 that is growing up to 2021, 2050 and after that there is a small decline, indicating that there is some fuel substitution or increased efficiency actually in the FFEs.

So, let's -- I mean the big question in the room for everybody is, oh, what's going to happen to the ZEV mandate and to the plug-in electric vehicles?

We want to say here that most of the quantitative requirements of the ZEV mandate revolve around new vehicle sales, right. The mandate requires OEMs to offer and sell light duty vehicles in different ZEV categories.

And by ZEV for this, for the purpose of what we are doing here, I'm talking about BEV and FCV.

Government offers incentives, so government is putting more of the mandate onto the manufacturers, but they also offer incentives for consumers to increase their demand. But the main focus is on the supply, actually.

I should also mention that we have kept all of -- I think I did, that we have kept all of the incentives the same for the entire forecast period. We can change it if anybody's interested.

Offering a vehicle and selling are two different

things. In order to sell a vehicle you're going to have to price it at a level that people are going to buy.

And we have seen for instance, at least for some of the EVs that has happened. There has been a price decline in order to attract more consumers.

The analysis or the pure focus on monthly sales report misses the point on dynamic interaction of supply and demand. That's important; not to be driven by the monthly sales reports.

Because on one month you're going to say, oh, EVS are going to go down the hill and another month you're going to see that, oh, it's going to go uphill.

Our forecast offers vehicles with their defined attributes and allows the consumers to make the choices.

So, all we do is supply the attributes to the consumers. They are the ones who are making choices. We don't do anything special to make them buy more EVs or less EVs or what have you. We just tell them, all right, these are the attributes, now you make the choice.

We keep all of the incentives in place through 2050, as I mentioned already. But we need to pay attention. Particularly when people are projecting based on the trends it's important to know market dynamics.

Example is OEMs lower price in 2012 to raise demand in California. Demand goes up in 2013 and the OEMs attempt to capture a new market somewhere else in the U.S. They cut down the supply in California and it's going to show up as the sales figure going down in California.

OEMs can increase production to meet demand in the tune of 400 a week, for instance -- I don't know, 400,000, 400.

It expands market to Europe and lowers the supply to California market, sales figures go down in California.

So, it's important to pay attention to the supply and demand interaction and what is causing it, or the dynamics of that. It is not going to remain constant. People are going to respond to that.

We also need to pay attention to the short term versus long term. Eventually, both of these manufacturers are going to increase their production and they are going to meet demand in both markets because they are in the business to make money.

If people want more EVs, they're going to produce them. You're not going to have a shortage forever. Also, if you have surplus for a very long time, they're going to change their strategies. They're

going to respond to things.

Our demand forecast, it's important for you to know it's a long term demand forecast. We don't care about those monthly fluctuations. That doesn't matter to us.

So, this graph again, based on the data from Ryan Eggers, analysis of DMV data, I think it kinds of tells you the story of the BEVs.

It was very interesting to me, and I don't know if anybody else is going to find it interesting, but if you look at age 10, this is age of the vehicles. That is, for instance, aged -- zero is 2013. These are the 2013 vehicles that are sold in 2012.

2002 is age 11. As you can see here, between 10 and 12 there is a peak here. And after that everything seems to go dead.

It was a surprise to me. It was a puzzle to me at least.

So, I went online and I did some research and I found out that actually the 11 peak, and at the age of 10 when you see everything is going dead that was in direct response to -- let me find the right thing. This was the 2011 ZEV litigation. I'm sorry, 2001 ZEV litigation that prohibited ARB from enforcing regulations in the 2003 to 2004 models.

That is why you see 2003 and 2004 models die suddenly here. You don't have too many eight, and six, and seven year old vehicles.

And then of course you know the peak that we have here are the new EVs that are being offered in the market and they are being sold.

You also see again that, well, government fleet are newer, a larger portion of them are newer EVs.

Personal has 5 percent. And you will see rentals are not really there. But there is some movement in the commercial sector.

You could also see the flip flop in government versus personal in age 11. You see that personal is higher than government. But when it comes to age 2, you will see government is higher than personal.

It kind of tells you, it's like, you know, you're looking at the DNA of something. It's like a tree when you are cutting across and you see the ages, and you can tell a lot of stories of what happened in those years. That's the same kind of thing that you could see here.

So, plug-in electric vehicles, in 2012, this is again based on the DMV data. And again it is important to differentiate between everything.

We have here EVs, NEVs and PHEVs. We don't want

to lump them together. We want to separate them so we can get a clearer picture of what is going on.

In the first column you would see total stock of all model years. This is going to include those 2002 RAV4s that goes in the peak, in the first peak in the other graphs. It's including those as well.

But it also includes the 2011 model years, and the 2012 model years, and the 2013 model years.

If you go to the next columns, you are going to see the number of 2011 model years in EV, NEV, and PHEVs. And, likewise, you are going to see the other ones.

Keep in mind that the 2013 model years that you see in the 2012 data, DMV data, are the 2013 model years that have been sold and registered as of October 2012. So, if your numbers are different from these numbers, keep that in mind. That's the difference.

For instance, you could say that 2014 model years could be selling right now. I don't know. Some of them are selling right now. So, even if it is 2013, we are selling 2014 models.

So, going to the last slide, ZEV, which we call here as BEV and FCV, and total LDV fleets this is the reference case. This is our forecast in the reference case.

You can see here that the ZEV totals in 2025 is 1.3 million -- I'm sorry, I think I'm -- yes. In 2025 it is 1.3 million. And in 2030 it is 1.9 million. In 2050 it's about 3.2 million.

We are almost getting there with Governor's order for the 1.5 million ZEVs on the road. If you add PHEVs to that, if you consider that ZEV, which I believe that they don't, I'm not sure. But if you add PHEV to that, then you're going to actually exceed the goal.

However, if you look at the vision statements, the 2050, we are falling short of that. In order to reach the 2050 goals which is, by the way, the reason why we included 2050 because nobody else had a forecast for 2050 so we were just being brave, actually, to make a forecast of 2050.

But if you look at those numbers, if you look at the ZEV in 2050, in order to reach the goals, the vision model -- according to the vision model, you have to have 80, I think 84 or 87 percent of the vehicles on-road have to be on-road vehicles. And these are all on-road vehicles, not new sales. They have to be ZEV vehicles.

As we can clearly see here it is not 87 percent. We are falling short of the 2050 goals, but we are reaching the ZEV mandate.

This is our Forecasting Unit team, Forecasting

Unit staff.

And if you have any questions, you can e-mail any one of us. We can direct you to the right numbers.

And if you have any questions now, we can answer those questions, if we have time.

So, we're going to go first to the Commissioners, if you have any questions?

COMMISSIONER MC ALLISTER: That was a great overview. It was very interesting. It's great to get the update every time. I know the survey work is ongoing and definitely, you know, I'm certainly very supportive of more and better information about the marketplace. I just think it's really critical to move forward and get scale.

And I was a little curious about the projections of vehicle types, fuel type over time. Obviously, we're mostly gasoline right now and then that gasoline goes down to, I don't know 60 percent or so by 2050, which is still a lot.

And I think we'll probably have the opportunity talk about this later on today.

MS. BAHREINIAN: Yes.

COMMISSIONER MC ALLISTER: I kind of want to keep things moving. But sort of what the scenarios look like and where the inflection points are I think will,

hopefully, emerge during the course of the day.

MS. BAHREINIAN: Wonderful.

COMMISSIONER MC ALLISTER: Thanks very much for that. Any other questions?

MS. BAHREINIAN: Sure.

COMMISSIONER MC ALLISTER: Okay, I think we're good to go on.

MS. RAITT: Thank you. So, we have a little change in schedule. Our next speaker is going to be Laura Graber, and then we're going to have Tom Carlson speak after lunch.

So, after Laura we're going to hear from Dean Taylor. And then lunch, since we are running a little behind schedule, lunch will probably be more like at 12:30. But we will have an opportunity for public comment before we break for lunch and again at the end of the day.

So, here's Laura, thank you.

MS. GRABER: Good morning. I'm Laura Graber with the Transportation Energy Office and I'm here to discuss our travel demand forecasts.

Due to the different characteristics of long and short distance trips we have separate models to forecast these types of passenger travel. The urban and intercity travel models in Dinesen forecast travel

demand in California.

Travel demand, in turn, drives fuel consumption. In the forecast presented today urban refers to trips of less than 50 miles and intercity refers to trips of 50 miles or more, regardless of whether the trips actually take place in urban or rural location.

Historically, passenger travel has been strongly correlated with population, employment and income levels. For example, during the recession travel flattened and in some cases declined after decades of increase.

In the decade prior to the recession, from 1997 to 2007, population grew 13 percent and real statewide per capita income grew by 16 percent. During this period auto vehicle miles on the State highway system grew by 19 percent.

Trends at usage followed a similar pattern over that period of time, also increasing by 19 percent.

All cases of our economic and demographic input data forecasts that income, population, and employment in California will increase over time but at different rates.

Here, trips under 50 miles account for the majority of California household travel. Urban includes most commute trips, as well as shopping trips, and trips

for any other purpose, recreational, anything as long as it's under 50 miles.

Here you can see our forecasts for our urban passenger trips. 2011 figures are based on actual trip counts.

Population and employment growth are the main drivers of urban travel.

Travel costs and time are also an influence on both whether people travel and how they travel. For example, whether they choose to drive, or whether they want to take a bus, or a train, or whatnot.

In turn, these trips drive passenger mile demand.

Also, one thing I'll notice is that we ran the reference fuel price case split, found that population and employment were more significant drivers of whether people traveled versus how they traveled, which Aniss just discussed.

Here, urban passenger miles largely reflect both the number of trips and the length of trips traveled by households.

Here, urban vehicle miles are in turn driven by the passenger miles. And, additionally, in addition to being driven by passenger miles, they're also driven by passengers per vehicle.

Trips of more than 50 miles account for a sizeable minority of passenger travel in California. This includes a few commute trips and many business, and recreational trips. Also, there are more -- on average more passengers per vehicle and a greater variety of modes available.

Again, the 2011 figures are based on actual trip counts. One difference between intercity and urban travel is that intercity travel in general is more sensitive to income levels.

As with urban passenger miles, intercity passenger miles are driven by passenger trips.

Also, due to more passengers -- or I'll go back here. Due to a higher number of average passengers per vehicle on the intercity passenger trips, each passenger mile traveled on intercity trips results in a lower average vehicle -- results in fewer vehicle miles traveled on average.

Historically, in excess of 96 percent of urban travel has consisted of automobile travel. Likewise, automobile travel has comprised more than 90 percent of intercity passenger miles traveled, with much of the remaining 10 percent consisting of air travel.

There are, however, several new developments in place for which we lack historical data that could

affect both how much people travel and how people travel in the future.

On the urban side Caltrain, a transit agency that serves the San Francisco Peninsula, currently runs its trains on diesel fuels, but plans to convert to electric power. After 2019, Caltrain plans to replace diesel trains with electric trains as the vehicles are retired.

If the process for electrification and incorporation with the high-speed rail system increases ridership, then fuel savings will be greater than the figures listed above for this particular transit agency.

On the intercity side, the California High-Speed Rail Authority plans to offer the public another travel option over the next few decades. After the San Francisco to Los Angeles corridor is complete, the High-Speed Rail Authority plans to implement a second phase of expansion and their system would provide service from San Diego to Sacramento. This would extend the system to a total of 800 miles.

Finally, one thing to note is that the figures I listed before assumed that income and population, as well as employment were the primary drivers of travel demand growth.

The implementation of Senate Bill 375, by Steinberg, in 2008 will most likely involve reducing

urban vehicle miles traveled. As more data becomes available to quantify the effect that Senate Bill 375 has on travel behavior we will develop a better understanding of its impact.

With this I would like to conclude my presentation and thank you for your time.

Are there any questions?

COMMISSIONER MC ALLISTER: Thank you very much, Laura. I just have a -- I think I asked about this at a previous workshop as well, but what's our kind of working relationship on the SB 375 front with the local MPOs and other relevant agencies at the regional level?

I think they're the ones that are developing those plans and, you know, getting them approved, obviously. But, really, the rubber hits the road so to speak down in those regions.

You know, most of my experience is with SANDAG, but they're kind of unique. But there are MPOs all over the State that I think have a lot of information that could be useful for us in figuring out where we think the VMTs are going to go over time.

So, I'm just curious about what that dialogue looks like.

MS. GRABER: Bob's been doing some of that work so I'll defer to him.

MR. MC BRIDE: Yeah, Commissioner McAllister, Bob McBride. I'm trying to get a running version of the California Statewide Travel Demand Model. And that's sort of an environment where the MPOs contribute a lot of their travel information.

There's also the California Transportation Plan which is going to try and use all the MPO planning tools and put out, by 2015, a forecast for 2040. And we're on an advisory group for that.

So there's -- we're aware. We haven't really incorporated much into our forecast. We're in a dialogue about what vehicle miles traveled really is and that involves the MPOs, and Caltrans, and ARB as well.

COMMISSIONER MC ALLISTER: It also kind of seems like the vehicle mix. I noticed from Aniss' presentation that you talked about, you know, basically assuming that all the vehicle types have similar VMTs associated with them in the modeling.

But I think there's got to be some fairly intense interaction between the VMT and the vehicle choice. So, I think, I mean obviously that's going to be difficult to model.

MR. MC BRIDE: Well, our limitation with respect to putting different VMTs on different vehicle classes and vehicles has been a barrier in our model that we

didn't have time to correct for this forecast, but we will.

COMMISSIONER MC ALLISTER: Yeah, that's going to require, I think, a pretty serious analytical approach to figure out what -- I mean you might be cherry picking of the low VMT vehicles going over to electricity, for example, and that would be --

MR. MC BRIDE: A couple of new databases to play with as well. The Smog Check database has very high level of detail on VMT down to the vehicle level. We're going to be working with that. It may take a while.

COMMISSIONER MC ALLISTER: Yeah, thanks.

MS. BAHREINIAN: Just one thing else that I should add is that our next modeling effort is to integrate the California Household Travel Survey data, which is travel, with our Vehicle Survey data. And we're in the process of working with the UC faculty to integrate the two models together so that we can answer exactly the question that you're asking.

COMMISSIONER MC ALLISTER: Oh, okay great.

MS. BAHREINIAN: We also have served on the advisory committee with Caltrans and we worked on the guidelines to the -- the RTP guidelines, and the modeling portion of it of how to incorporate all of these.

And one of the comments that we made in those, but it's not really possible by their modeling ventures, was to incorporate different fuel types into their modeling efforts because currently they don't include all of the different fuel types, but they have limitations as well.

COMMISSIONER MC ALLISTER: All right, great. Okay, thanks. I mean I realize this is an ongoing process from year to year, as well, so don't expect it all to happen right now.

MS. GRABER: Any other questions?

MS. RAITT: Thank you, Laura.

Our next speaker is Dean Taylor from Southern California Edison.

MR. TAYLOR: Good afternoon. Thank you for inviting me to speak here. I've been with Southern California Edison, in the Transportation Electrification Group for over 20 years.

I mention that only because this issue of forecasting can be very humbling after watching this, you know, both on the trains, forklifts, cars it's taken a long time to make things work. You know, 20 years is a long time to be watching this industry so it's finally, from that perspective, very exciting to see things done.

You might ask why would Southern California even be invited. We have a need for forecasting data. We have long-term procurement planning that we do with the PUC and a lot of the IEPR work goes into that.

So, for example, we have to do 10-year purchase contracts, in addition for our transmission distribution long-term planning, and making planning and purchases there is very important.

Today's presentation is really just going to focus on light duty plug-in electric vehicles. I am just going to make a few verbal comments that aren't really covered in the deck regarding the other things because we have looked in the past at electric trains, electric forklifts. A lot of these things that we don't have anything we're willing to share with you today mainly because these markets have been kind of on again, off again.

Our industry's trade coalition, CalETC did do a big study back in 2007, and several years before on 18 different market segments. We've internally looked at some data. We're working on some new data in these areas and we're more than happy, you know, to talk to staff more.

And we're also, just in conversations with staff, very pleased that they are adding, for example,

light rail and subways into the model. We encourage to, you know, add more such as the Caltrain that's being done. L.A. has passed Measure R, so there's a whole lot of light rail construction going on currently.

In addition, we understand staff is also adding the port electrification into the model and that's also very good. We would encourage that.

As far as forklifts, there may be a few there in the existing industrial segment. Those are the kinds of things that would be good for kind of continual improvement. I'm sure that staff is always working on their model, just as we are.

So our model in many cases relies on data, but we're always hungry for more data, so I'll get into that.

The first thing in building the model is how many cars are coming. And this chart is basically showing three key lines. The blue line, which is a low case based on the CARB's ZEV mandate, a green line which is an average of eight independent studies. It isn't our work there at all. And then the high case which is basically a variation on the green line.

We've been collecting various studies for over four years using this basic methodology. Some of the studies that we're using for the green line have gotten

old, so they've been kicked off. We're constantly updating this. About four or five years ago there were a lot of studies out there.

You know, now the frequency of new studies coming is much less.

I should also mention the blue line, we worked extensively with Elise Keddie at ARB, as well as people on her staff to not just look at the ZEV mandate, but also the really hard to understand part which is all of the credits that go out. There's a lot of over-compliance credits, existing bank credits, et cetera.

So, our low case may look a little different than like published press released because there's a lot of work that has gone into understanding, you know, how many cars would actually be produced and also whether they're plug-in hybrids or not.

So the market today, there's over 10 plug-in hybrids on the market today, over 30 expected by the end of 2015, and several are selling at levels far more than mandated.

And by the year 2018 there will be 18 automakers mandated in the market, basically, or that's actually counting a couple like Tesla that are technically not mandated, but are certainly producing a lot of cars.

So, that gives you a sense of why we think the

green line is a very important line that is probably -- we're not calling it the medium case, but the expected case because so many automakers are doing more than what is required.

To give you a little bit of depth, I mean we'll file formal comments later to get into the next level of details of how we did things, but we basically start with the DOE Annual Energy Outlook to get the sales forecast for light duty vehicles. You know, kind of like a rolling average.

We then take that and California's 12 percent of the U.S. that's based on several data sources.

Then we take that and covert it at roughly the 38 percent level into the share for SCE territory.

And that's we buy R.L. Polk data and that's also, then, based on historical hybrid sales. So, hybrid sales are coming into our territory than, you know, maybe a little higher level than other parts of the State.

And then, finally, there's several ways our numbers are more -- we make the numbers more conservative. So, for example, we've thrown out some of the studies that were too high, and specifically a Black & Vetch, and ID Tech, and there's been others in the past that we've kicked out.

We take any national studies that we have and we gross them up to account, you know, 2.2 times more than California's natural share are coming to California. When, in fact, the actual data right now is showing that it's at about 3 times the level are coming to California compared to our expected share of sales. And so that's another way we're being conservative.

And then, finally, in the early years we're reducing the numbers a bit just based on our own market observations and in order to be even more conservative.

The actual studies used are generally from consulting firms, investment banks, nonprofit research institutes, governments, so anything from Citigroup, Morgan Stanley, BCG, EPRI, Gardner, Bloomberg, Pike, and then the CEC's own most recent work. These numbers are tracking with what I was just hearing this morning as far as the numbers you saw from the prior presentation.

Just some other quick thoughts is that generally our effort over the last four years has been pretty accurate, within about 1,000 to 1,500 units of the expected case. So, the methodology is working so far.

And current trends, another maybe reason why the green line is the expected case is that, you know, if you look at the current sales of the Volt, the Prius and the Leaf, you know, those three could be meeting the

entire obligation of the ZEV mandate in 2017 if those trends continue. Yet, you know, it's far more than those three models would be mandated, so you would have another 15 or more.

So, again a key things is we're -- I just want to emphasize these eight studies. We didn't get into doing any kind of work like you've seen earlier of vehicle choice models, demand forecasting. We're not even doing supply forecasting. We're just kind of using these studies as a black box and just averaging them.

So, different studies have different methodologies. Some probably do get into the demand side. Some are probably the more supply side using a whole range of methodologies. And, hopefully, by averaging this we're kind of taking out some of the really high and low cases.

This chart is just thrown in more because it's kind of interesting to take it out of the theoretical into something more concrete. But I do want to emphasize this isn't used in our forecast. This isn't used in any of the eight studies. But it is kind of useful to start putting names and who are the high volume producers right now in California, you know, of the cars that are on the road.

It is certainly, you know, the cars like the

Prius, and the Volt, Leaf and the Model S.

The cars you see in red there are all on the market, so those are the 10 or 13 that are here today.

This is a list of almost 30 models here and this isn't even a complete list. The Volkswagen group is an example. they're very large, one of the top five automakers on the plant. You know, they own Audi, and Porsche, Lamborghini, Bentley. They have announced over nine models, but we don't show all nine on here. I think we have four from that automaker on here.

So, there's certainly a lot more than this. And, obviously, it gets a little more uncertain as time goes out. But this is just to give you a sense.

This list is also kind of specific to Southern California, so plug-in hybrids are currently dominating where we are, possibly because the charging network isn't as maybe robust as San Diego. Also, you know, the distances are very great.

You know, I personally have a Chevy Volt. I put 18,000 electric miles on it. I'm getting 130 miles per gallon. My friends are teasing me because they're getting 200 miles per gallon.

So, I mean the point is that plug-in hybrids are I think the most -- if you read these eight studies, most of them are saying that plug-in hybrids will

dominate because they're just such an easier technology. I never, you know, use public charging. I never have range anxiety, I never even think about that. You know, just plug in at work, plug in at home.

And, you know, also I'm driving much, much more than battery EVs. You know, the typical, average data right now on the Leafs is much lower, like 7, 8, 9 thousand miles per year.

So, you know, that would be really -- I mention that because that's an area where we're very interested in trying to find more information on miles per year by make and model, and kilowatt hours by make and model so we can get a better handle on this. That's something you'll see later that we don't have in our model. We're having to use some more basic assumptions. So, that's an example of where more data would be really useful.

I'm not going to have time to go through all of this, but it's a pretty fun list, you know, of all the different cars that are coming out.

And one thing I think that's kind of cool is the high end automakers that, you know, when you start seeing Teslas and, you know, Lamborghinis, and Land Rovers, and Porsches, and BMWs, and Mercedes all competing in these high end markets that's probably a good thing because those are probably a great place for

a lot of these cars to come in.

Yet, at the same time -- you know, I think I'll go and just show you prices really quick. The last slide, it's -- I wasn't going to use this appendix slide, but eight plug-in hybrids have a lease price of $139 to $285 a month. So, this is really, really reasonable.

So, this kind of counters what I just said here about all the luxury cars coming to market. You know, yes, there are some Teslas and some other very luxury cars coming, but there is a price war going on right now and some very interesting -- oh, I'm sorry, going back to where I was.

COMMISSIONER MC ALLISTER: So, I guess the question is are those loss leader -- are those initiatives that are kind of artificially low, not quite market rates for the leasing in order for the companies to get some experience with those cars, or sort of what's the situation at this moment earlier on in the market?

MR. TAYLOR: Yeah, that's a really --

COMMISSIONER MC ALLISTER: Could you please put some words in the mouths of the manufacturers, please.

MR. TAYLOR: Well, I'll answer this mainly because I commissioned a study called Pricing for

Success: The Secrets of Automotive Industry Pricing, back in both ’96 and then again in ’99.

And it’s funny you asked because I was just talking with ARB staff this morning about that very study. There’s four ways that automakers price their cars. And cost-based pricing is actually not really used.

If you actually interview retired automotive economists, you’ll tell you that things like CAFE are fair game. In other words, what happens in the automotive industry is basically cross-product line subsidies.

You know, some cars may have a $10,000 margin, other cars might have a negative, you know, minus $2,000 margin.

And, you know, as far as the automotive black box of pricing that’s fine. So, automotive industries all the time, you know, what you’re seeing today is competitive pricing because one automaker’s lowering their price and another is also.

And are they making money? I mean that’s the million dollar question. I mean that was debated for a decade or more on the Prius.

COMMISSIONER MC ALLISTER: On the flex fuel issue, that’s kind of what I was getting at before. You

know, flex fuel is necessary for compliance with CAFE or, you know, with emissions standards broadly. And the manufacturers kind of haven't had the incentive, necessarily, to make sure that alternative fuels get used with those cars, but then they do have an incentive to get them out in the marketplace, the dual fuel kind of capability.

So, you know, that dynamic is obviously important for understanding the marketplace.

MR. TAYLOR: Yeah, I mean, there's some famous quotes of Bob Lott saying, "They never should have killed the electric car because it would have allowed them better to compete with Toyota." Because Toyota, with the Prius, was literally getting billions of dollars of free advertising that GM wasn't.

You know, they were capturing young buyers. They were changing their brand image, et cetera.

So, there's a whole bunch of other factors that do have dollars and cents values. But, unfortunately, every automaker does their pricing differently. It's done, you know, in their back skunk works and nobody really knows, you know, is part of the problem.

COMMISSIONER MC ALLISTER: Well, and they can't allow that information to get out or else everybody would go for the low margin cars basically, right, where

they’re getting the best deal, or a lot of people would.

So, I guess, so I remember I used to do research on small batteries, you know, portable electronics and portable batteries and so was involved in a few battery events back in the day. This was sort of in maybe the late 90s, early 2000s kind of thing.

And I remember having lunch at one of these conferences with a young engineer, recently graduated from Stanford, who was working for an electric vehicle -- you know, working for a very highly secretive electric vehicle company based somewhere in the Bay Area and they were going to make high end sports cars.

And I was asking him about it and I, you know, was sort of recently off the hook for the Peace Corps, and was a little bit suspicious of the high end sports car model as sort of, you know, going after that highly consumptive marketplace and was a little dismissive of that.

And it turns out I was completely wrong and sure enough they’ve executed that business model really to a T.

And as he explained back, you know, 13 years ago, the idea was to use the high margin vehicle to develop the IP and then bring that IP to the market, and that’s kind of the way it’s played out.

So, my question is, at least at a high level my question is where's the -- and this is for anybody today, really, and I think we'll talk a little bit more about this later.

But as far as technology goes, you know, is the electric platform -- you know, all those cars, there's an increasing array of cars as you've noted here, is the electric platform -- how much tweaking, how much improvement, how much optimization is kind of left to do there?

It's come a long way in the last 10 years and, you know, is it this idea that you could have different fuel sources producing electricity onboard, and then you'll be essentially plugging and play onto an existing, relatively cross-functional platform?

You know, I guess I'm wondering sort of how much more development there is down the -- how many competing sort of approaches are there and how much developed do you see coming down the road?

MR. TAYLOR: That's a really long answer -- long question to answer. I could try to give you a few snapshots because I just happen to be working on a briefing package for the Chairman of our Board and so I've been hunting, you know, for all the very best information.

And so, for example, some of the -- taking stuff out of like the NPC Study, the National Academy of Sciences Study, several others that were kind of studies of studies, you know, battery prices for battery EVS, at least, let's say were up at over $1,000, $1,200 a kilowatt hour. Now, they're less than $500 to $600. Most studies are saying they can get down to around $200, possibly, you know, less.

Plug-in hybrids, you know, have a slightly different cost curve because they have a different power to energy ratio.

So, that's one very encouraging data point there.

As far as, you know, potential for improvement in batteries, I mean when I started a typical battery life was 400 deep discharge cycles. That was back in the early 90s.

You know, now, work that we did at Southern California Edison over five years ago, almost ten years ago, actually, we were getting close to 3,000 or 4,000. That's a factor of 10.

You know, watt hours per kilogram was done at -- back 20 years ago was at, you know, at 30, maybe less.

You know, now we're up at well over 100, 120 with many different technologies that are potential out

at, you know, 200 or even more. So, you get some sense of the improvement.

I think J.B. Stobbel at Tesla says batteries in general all the different attributes are improving at about 5 to 10 a year.

On the other hand I would say that like a plug-in hybrid doesn't need any improvement. I mean it's ready today. In No Alt Fuel, we've been trying to do this for 40 years and No Alt Fuel has made it to a million units.

And probably the number one reason for that is the chicken and egg problem. And of them, the plug-in hybrids are the only one that really doesn't have it.

I just went and bought a car, plugged it into my garage and boom, that's it. You know, I got a ton of use, a whole house rate for the house, and it's very, very simple.

So, of all the different Alt Fuels out there, other than flex-fuel vehicles which, you know, have already hit that, you know, there's seven million or so in the country, I mean it's plug-in hybrids that are most likely to do that.

And, you know, any technological improvements in batteries is just gravy onto that. You know, it's very -- it's most likely to hit the million or for that

matter ten million units in operation in the country.

So, I think you can do both. I think you can do the continuous improvement of having R&D, of getting better and better, but I think we're there as far as having technology that's ready for the mass market where you have very, very happy consumers.

COMMISSIONER MC ALLISTER: So, as new -- at least in the electric part of the segment here, as new sources of on-board electricity come in, the platform is there to receive them is kind of what you're saying?

MR. TAYLOR: Yeah, and as far as the on-board, I mean when I started in this business our CO2 emissions were 70 percent in the early nineties. I did a study with Roland Long of NRDC on that.

So, our CO2 for the grid in California has been very, very clean. And so we've maybe gone from 70 percent less CO2 to 80 percent less.

And, of course, you know, if you have solar on your roof you're at 100 percent less.

So, you know, as far as the attributes of the electricity going into the car I think it's pretty darn amazing.

As you know, the reason why L.A. was kind of the leader on this is just the fluke of our smog problem, and that mainly had to do with not CO2 back 20 years

ago, it had everything to do with NOx, and ROG, and PM, and criteria air pollutants.

And that's where we're at like 99.9 percent, you know, reductions.

COMMISSIONER MC ALLISTER: Great. Well, thanks for that answer. I know it was a not very well framed question.

MR. TAYLOR: Anyway, this slide is kind of the punch line slide. This gets into how many gigawatt hours or millions of kilowatt hours. And this is showing, basically, up at 2,500 -- or in 2022 I think the high case by CEC staff was right around 2,100, 2,200. So, those kind of numbers are fairly similar.

What we do here is take the basic population numbers you saw earlier, this is the medium case. The high number is basically 4,400 kilowatt hours, you know, per vehicle. Behind that is a whole lot of other things like how many miles per year are the different cars driving.

What we've had to do is some simplifying assumptions assuming that the market, and sort of that knowing make and model by each different car, we just have to simplify and say we have plug-in hybrid 10s, we have plug-in hybrid 40s, and we have battery EVs. You know, on average we have them going about 11,000 miles

per year.

And we have a split between the two. We look at a lot of these different studies, and as well as the market, and what people are forecasting on that. And, you know, other factors like miles per kwh. This is the area where we're very eager for real data.

We know that ARB, for example, is hiring -- is trying to hire UC Davis to do a detailed study. I was just talking with them this morning and I think they're going to be quizzing the automakers to try to get, you know, miles by make and model per year.

So, this is the key thing that we're using that we're giving to the PUC for our various proceedings that we're doing there, be it the long-term procurement proceeding, the general rate case, or some of the other proceedings that we need to do.

And these are probably -- I haven't talked to the other utilities. I'm sure we'll be talking more to kind of compare our notes with how -- you know, as far as the fundamental assumptions here.

But again, we want to move from hypothesis into having real data as fast as we can.

COMMISSIONER MC ALLISTER: Could you talk a little bit about the rates that Edison has as options, or the rates that a typical plug-in electric vehicle

owner might choose from or might choose?

MR. TAYLOR: Yeah, and we can -- in addition, when we file our written comments we can send you more detail.

But in general we have three rates. Your typical domestic rate, which I think you're all familiar with, is this kind of the same around the State where the more you use, the more you pay. And so if you have a lot of stuff, you can get up into Tier 3 and Tier 4 and be paying quite a bit.

So, because of that we have two optional rates that are much more favorable. And one of them is a whole house time of use rate. So, that's what I have. Everything, you know, your air conditioner, your TV, your lights, your car, everything is on that. So, you get really good prices off-peak. In my case, roughly around 17 cents is on average. I mean partly because I'm factoring I'm using at a Tier 2. It goes down as low as almost 10 cents a kilowatt hour, which is pretty darn good.

Roughly, I think the DOE E-gallon calculator had us down at, you know, about a dollar a gallon. I think the average in California was about $1.50 a gallon, you know, equivalent.

If you take -- you don't normally think of that,

but you can convert, you know, cents per kilowatt hour into dollars per gallon.

And then the third rate, which is not used very much, is a separately metered rate. We've had that since the mid-nineties. There, you'd have to install a separate subpanel and a separate meter. So, there you can get down like, you know, depending on which utility to 9 or 10 cents per kilowatt hour.

The challenge there is the cost of having to have the electrician come in and wire and do all of that.

So, you know, we do have some people doing that. I think San Diego, because they did a really special rate experiment and push, they have maybe a higher uptake of that. But I think it's heavily dominated by a few Leafs, a few legacy vehicles like some of the RAV4s that are still out there.

And I thought I'd just mention we had a white paper that was in the news, recently, on the six kind of key learnings that we've had. Maybe I'll just quickly touch on that.

Our main approach to managing the grid is to meeting our customer needs. And one of the interesting things is we're doing lots and lots of transformer checks to make sure that our distribution system can

handle these.

We've had about 400 upgrades, but we can only attribute about four of those to electric vehicles causing, you know, that transformer.

In other words, sometimes we'll find a transformer that needs replacement but it is not because of the electric vehicle causing that to happen.

The other thing we're realizing is some of the auto -- with Smart phones and Smart cars needing a Smart grid you get some interesting new possibilities.

And, you know, the Chevy Volt I have, you can just say I want to be done by 7:00 in the morning. And so we're trying to really encourage that. We think it's just good because it doesn't then have some artificial spike starting at 9:00 at night, when the time of use rate begins, or midnight, you know, when you have a whole bunch of cars turning on. In other words, because everybody's drive patterns are different, you know, it's better for people to use this feature on their cars.

We're trying to start educating that. All of our new educational materials talk about setting it so your charge is done by when you want to leave in the morning.

COMMISSIONER MC ALLISTER: Do you have any more initiatives on the demand response realm? So, sort of

being able to modulate, say, the charging in a way, if you need to for grid responsiveness?

MR. TAYLOR: Yeah, I think that's where we're heading. I think that's -- you're hitting on a really interesting topic. Because potentially a car is a de factor storage device because you can ramp it up, ramp it down. You know, you don't have to be charging all the time. At 6.6 kw you might be perfectly happy if we turned you down to 4 kw, instead.

COMMISSIONER MC ALLISTER: Or 8 or 10, you know.

MR. TAYLOR: Yeah, so those are -- there's tons of interesting things you can be doing. The codes and standards work is, I think, all headed in that direction. I think we're doing, for example, a demand response workplace charging pilot to really understand what is the willingness of our employees to handle that. It hasn't been launched, yet, but the funding is all there. The program design is almost done. The vendor is almost selected. So, that's an example of these kinds of things.

So, I think where you're hitting at is the term "renewable integration." You know, the concept here would be to be able to have these cars be de facto a way of handling renewable integration, being a form of Smart storage, basically, you know, by being able to do that.

In other words, you may not even have to go as far as vehicle to grid if you can get most of the benefit for very little of the cost by doing demand response, Smart charging, renewable integration type activities.

Moving on, what we find our customers most want to know is probably about our rates. We have -- monthly, we have over 15,000 customers hitting our website and about 46 percent of them are going first to our Rate Assistant Tool. We have a really cool Rate Assistant and five easy steps to kind of compare the cost to operate an EV and a gasoline car, or a plug-in hybrid and gasoline car.

Then you also can go and get an individualized Rate Assistant, as well.

And then, in addition, we're basically finding that people lose their range anxiety, which is kind of, I think, you know, that is something that most people have heard. But we have some survey data now showing people that once they've been with their car awhile that goes away.

And no surprise here, the multi-unit residence is going to continue to be a really, really huge challenge. We're finding, you know, really slow uptake and lots of challenges.

I think if you talk to, you know, eVgo which is the company that's under the PUC rate settlement, they're having to put in make-readies. That's going very, very slow. It's just this is a very challenging environment.

Or if you talk to the plug-in electric vehicle collaborative folks who are working in this space as well, they would tell you the same thing.

And then as far as our cities we did a huge push, partly because of the separately metered rate and needing city inspectors to improve it.

We've gone out and we have over 180 cities. We've virtually talked to all of them and they're all doing a really terrific job and they're all, you know, up and ready to go. So, that was over like a three-year effort to go out and work with all of our cities.

And that's -- maybe, just lastly, this is a fun slide in. We're over 12,000 EVs now. There's over 120,000 EVs in the country.

And then, you know, we're on track for 80,000 EVs to be sold this year. That's kind of some of the highlights of this slide.

Thank you very much. Any questions?

COMMISSIONER SCOTT: I did have one other question. It was a little bit more in the weeds, I

guess, back on slides 3 and 4.

And you mentioned that you had, as you were pulling this together you kind of excluded the high cases in some instances, and excluded the low cases in some instances, and I was just wondering how you put that together.

I guess in my head I have sort of like a scientific scatter plot kind of, you know, and some data points are either really low or really high and so you kind of focus in on the middle. Is that what you did is you eliminated some of the studies?

MR. TAYLOR: Actually, we ended up there were no low cases to eliminate. And at one point we used to have a separate high case that was based on studies because there was like five or six studies up in the high case, and there was like 15 studies in the middle case.

But what has happened is there's been fewer and fewer high case studies. And even in the high cases you'll see sometimes there are some that are just outliers. They're just so beyond the pale, so to speak, that they weren't really usable. They just didn't have enough credibility or mathematical, you know, rigor behind how they even came up with their numbers.

COMMISSIONER SCOTT: Okay, thanks.

COMMISSIONER MC ALLISTER: Yeah, so I've gotten my questions answered, so thanks very much for doing it on the fly.

I'll pass it back to Heather.

MS. RAITT: Thank you, Dean.

So, now as I mentioned, Tom Carlson from Sierra Research will speak after lunch and we'll move on to public comment period.

So, if anybody in the room, starting off with anybody in the room who had comments or questions for any of our speakers this morning, please go up to the microphone and introduce yourself.

No questions, okay.

Do we have anybody on WebEx who has questions? Nothing there.

All right, I'll go ahead and open up the phone line. So, if we have anybody on the phone, the lines are unmuted. If you have any questions, please ask.

Any questions? I don't hear any. Okay, thank you.

COMMISSIONER MC ALLISTER: All right.

MS. RAITT: All right, so we will adjourn for lunch and come back at 1:10 and start the afternoon session.

COMMISSIONER MC ALLISTER: Great. Thanks

everybody, have a good lunch.

(Off the record at 12:12 p.m.)

(Resume at 1:16 p.m.)

MS. RAITT: All right, we're ready.

COMMISSIONER MC ALLISTER: Okay, let's get started for the afternoon.

MS. RAITT: Okay, good afternoon. So, we're going to go ahead and restart the workshop and our first speaker is Tom Carlson from Sierra Research.

MR. CARLSON: Thanks Heather. Good afternoon Commissioners and those of you that are still here after a warm lunch, if you went outside.

I am here, as has been noted, to talk about the Vehicle Attribute Forecast that Sierra's prepared to support the Energy Commission's 2013 IEPR efforts.

And before I begin I just want to set the record straight that these are draft forecasts. We're very likely to incorporate some revisions in preparing our final report to the Commission this fall.

And comments and feedback that we receive today will certainly be considered as we prepare our final forecasts.

Down arrow, thank you. I'll begin briefly by summarizing what we refer to as attributes and some of this stuff has been touched on earlier, so I'll try and

pick up the pace. But also kind of discuss the structure in which they're being specified to support the IEPR modeling.

The attributes, as I'm sure most of you know, are used as inputs for the consumer choice modeling to estimate the future characteristics of our California vehicle fleet.

They include price, fuel economy, the number of models within particular segments, as well as a number of performance and utility metrics like acceleration performance from zero to 60, towing capacity which is important for pickups and sport utility vehicles. Range was mentioned earlier, storage volume, things of that nature.

And as I note here, we generate these forecasts for a total of 18 light duty size and vehicle type categories, which I'll display shortly, and also by technology and fuel groups that feed the sort of forward thinking demands of the forecasting model that include just conventional gas, as well as the conventional diesel, and a suite of alternative fuels and technologies that are shown here.

I need to set the record straight as to the scope of these draft forecasts. Through no fault of CEC or Sierra, we were under fairly tight time constraints

to get our draft forecasts pulled together and this slide, as a result, highlights the scope and key elements of our approach.

As might have been alluded to earlier, we focused on attributes only for the light duty fleet. And we used a combination of work products that were out there in the public domain, a number of which we thought were quite helpful.

First and foremost of which was the National Academy of Sciences' Transitions Study here that, fortuitously, was released just a few months ago.

And as I'll talk about a little bit further, the way the study was designed and the projections that it contained were developed lent well to the structure of the attributes that we needed to feed into the consumer choice modeling.

We also utilized some estimates that we were given access to that Bosch presented to the Commission at a recent workshop.

And we utilized the 2012 ZEV amendments from CARB to deal with a couple of elements of the forecast that were not part of the scope of the NAS work, and I'll discuss that in a little bit more detail later.

And then we also had to update historical data from the previous IEPR effort, adding two additional

model years of data upon which to launch our forecasts, and I'll talk about that a little bit more as well.

For those of you who, like me, can barely see those categories, I hope you can read them on your hardcopy.

These are the 18 car and light truck classes that represent the way we segregate the light duty fleet. And they generally, but not universally, line up with regulatory standards like CAFE, in particular.

And as I think I've footnoted here, CEC recognized that by understanding that one of these small cross-utility vehicle categories that they use actually spans the car and light truck definitions that are used in the CAFE standards.

And I've also listed some models here that fall into those categories.

We also, as I noted earlier, have to generate these forecasts by the fuel groups. I've listed them here specifically and I've identified in shading those two that we've agreed with staff to not focus on in these draft forecasts, based on where we felt other priorities needed to be directed.

And so those are the tech groups and the vehicle classes within which we have to generate attributes by model year. And these are the attributes.

Again, I apologize for the small fonts. And for those of you looking at your hardcopy now, I suggest that you look at the screen to see the shading. The two that I've shown near the top, MSRP, retail price and on-road fuel economy are really the most critical ones that staff has indicated the consumer choice modeling is most sensitive to. And those are the ones we've given the most effort to in developing our forecasts.

There's the complete list that I noted earlier. I've also identified in red that per staff's direction we've added a few new attributes for this IEPR, towing capacity, vehicle lifetime, storage volume, battery cost for hybrids, plug-ins, electrics, et cetera, and charging equipment cost.

I'll mention right now the charging equipment cost information that we have in here is sort of placeholder information that we're going to look to modify.

But as I said, we've tried to focus on putting more resources behind those attributes that the staff has identified the modeling is most sensitive to.

And as I've listed at the bottom, there are other attributes, weight, horsepower, engine size that we also track so that later, as we refine our analysis we can look at tradeoffs between how manufacturers will

work to either increase or maintain performance as they do things like light-weighting vehicles and being able to downsize the engines, and so forth.

So, as I alluded to a bit ago, the first step before we actually do the forecast is getting the baseline estimates together. And I want to summarize a couple of the things that we did here.

As I noted earlier, the 2011 IEPR went and included historical data through 2009 model year.

And for this IEPR we developed independent estimates of the historical data from 1992 through 2011, in part because we had to add additional attributes that weren't in the earlier dataset and we wanted to make sure we were doing things with a consistent set of data sources over all these years.

So, we went back and used what we had at hand in the available time, U.S. fleet vehicle sales. But we're planning to update that for the fall final product with California-specific new vehicles sales that we've already purchased from Polk.

And as I've noted here, we've used data from newer model years, 2012 and 2013 to do some preliminary testing of our earlier forecasts.

One of the other things that I want to point out, that I think someone else alluded to, is besides

just making sure it represents California, we have some experience working with comparisons of California versus U.S. sales from other work that, you know, clearly indicate differences in the light duty fleet distribution here versus the U.S. as a whole. And that's especially important for what we know are higher fractions of hybrids, for example.

I'm going to give a brief overview of what we did with these attribute forecasts once we put the baseline information together.

In this first go-around we generated forecasts out through model year 2035. We're going to update that in the fall to go out to 2050. But as I'll explain in a little bit, given the policy scenarios that we've looked at so far that wasn't as critical as it will perhaps be.

And those scenarios that we've looked at so far assume compliance with currently adopted standards. And those standards basically reflect regulatory requirements that go out to model year 2025, but not beyond.

And as I noted earlier, the primary source for our forecasts was the 2013 NAS study. And one of the things I'll go into a little bit of detail is we used that study that was done to look at everything regulatorily that I've listed there, except for the ZEV

mandate. So, we had to make a couple of adjustments to reflect compliance with our California ZEV mandate.

The key scenarios that are encompassed in the NAS work are listed here. There was a fourth one, a business-as-usual case that wasn't really relevant for discussion purposes.

But the three that are, are a reference case here which represents adopted Federal regulations through 2025. And as I alluded to, with adjustments this is the case and the material that we extracted from that study that we've used for our draft forecast.

NAS also looked at two more aggressive cases that they've labeled mid-range and optimistic, defined here largely to seek specific levels of reductions in out years of 50 percent for the mid-range case by 2030, and I believe it was 80 or 85 percent for the optimistic case in 2050.

And both of those assumed additional policy support, as I've noted here. And in the optimistic case really stretch goals that involved sort of stretch successes in research and vehicle design that currently we can't yet see.

And so the technology penetrations from the NAS study were divided into two groups, those improving the power train, the engine, the transmission, things of

that nature.

And the NAS work used simulation modeling material that was partially used by EPA for their 2025 CAFE or greenhouse gas standards.

And then the other set of technology elements that the NAS work looked at were load reductions, improvements from lighter weight materials, reducing load through aerodynamic drag, rolling resistance, and some accessory efficiency gains.

I'll show material later that kind of reflects this in toto. But in the area of the power train improvements the NAS members generally found that there were quite a number of reasonably cost-effective fuel economy improvements that could be gained, you know, going forward from specific power train technologies like gasoline direct engine ignition, and turbo charging of different flavors, also combined with variable valve timing, Atkinson cycle engines, cooled EGR, advanced transmissions and the like.

And they were careful when they looked at the powertrain improvements and the load reductions to account for the interactions between the two, in particular relating to efficiency gains allowing for downsizing.

And I haven't looked at this in gory detail, but

as I've given it a cursory examination we generally believe that their powertrain benefits are in line with the regulatory estimates EPA used for their 2017 to 2025 standards.

With respect to costs, they came up with estimates that generally reflected fully-learned, high-volume costs and applied what we thought were reasonable phase-in schedules under the Federal regulatory dictates that they were focused on.

And there were separate estimates developed for conventional internal combustion engines, hybrids, plug-in hybrids, pure electric vehicles, and fuel cell, and CNG vehicles.

And as I've listed here, there's cost elements that generally tie to different battery and motor sizing required for each of these technologies that are listed here.

Some assumptions that the NAS panel made that allowed them to develop this, I think, fairly well-conceived, obviously highly peer-reviewed effort that looked out as far as they did were things that we'll be up front about here. And we've made a couple of modifications, one of which I mentioned already.

They, based on what the current thinking was, didn't think that compared to gasoline internal

combustion engines that diesel engines were going to have further efficiency improvements at the rate that the gasoline engines would be going forward from this point.

And so they assumed that manufacturers from here forward would focus, based on cost and available technology, on improving the efficiency of current internal combustion engines with some of the technologies that I mentioned a couple of slides ago.

They also assumed that lithium ion is the long-term technology for plug-in hybrids and battery electric vehicles.

They looked at some other possibilities, but for the thinking that they had to deliver this was their assumption and we also utilized it.

They came up with estimates for weight reduction that ranged, as I've listed here, between 15 and 20 percent depending on whether it was a car or truck, by 2030 relative to 2010. And we used those for doing some load reduction improvements that I'll talk about in a little bit.

And their costs were all marked up using a universal factor of 1.25 to translate production costs to retail equivalents.

We think that that might be a little low,

especially in the nearer term, but based on what we've had to do to get to this point we have not changed it, and are comfortable at this point leaving it there for this first go around.

And then, lastly, an important assumption is as now manufacturers face roughly a decade and a half of more stringent fuel economy or CO2 standards for the light duty fleet, unlike has been the historical case where we have seen and it's been clearly documented, fairly significant improvements in vehicle performances, and increases in size to add utility such as storage volume, the NAS committee decided that given the stringency that manufacturers are going to face over the next 15 years that these performance, and to some degree utility metrics, are largely going to flatten out. And we've just assumed what they did is that they're flat from this point forward.

We utilized a spreadsheet model that was developed under this study called LAVE-Trans that was actually developed, as I understand it, for analysis of California energy future and then, ultimately, expanded to look at the U.S. for this NAS study.

And we'll be trying to take a look at that researcher's progress with that version of the model in looking or using it to directly look at the ZEV mandate

as we move forward from our draft product today.

We used relative fuel economy improvements and vehicle price forecasts for the technologies that I've listed there in the second bullet right from the NAS work, for their reference case, and scaled them to our historical estimates that we had in model year 2011, but that we had broken down by individual vehicle class within each of the technology or fuel groups.

And then for diesels we recognized that we had to do something, other than just leaving them alone. And so we utilized the separate load reduction gains in the NAS work, light-weighting and the rolling resistance, an aerodynamic drag estimates, and used those to forecast diesel fuel economy improvements and price changes going forward from the current baseline.

We also scaled our future battery cost estimates from the mid-range case. We couldn't, in the published work, find cost estimates for the reference case. And they're fairly consistent after about 2025 or 2030, anyway. And used those to generate our forecasts specifically for battery costs as a component of overall retail vehicle price.

So, I talked already about the two most important attributes and summarized some of the key elements of the utilization of the NAS work to generate

estimates of future fuel economy and price. We also made forecasts of model availability that some of the earlier presenters alluded to.

For the conventional gasoline internal combustion engines and the hybrids we were able to scale those directly from sales projections that are an output of the LAVE-Trans models, compared to number of models that are available in those categories today.

For diesel engines we took information that Bosch had presented to CEC and grew model availability based on known or projected estimates that they provided after model year 2018, but we didn't do anything beyond that at this point.

Other keys that I've noted in the slide here is for plug-ins, electric vehicles and fuel-cell vehicles we knew we had to do something to deal with reflecting ZEV compliance here in California.

So, we used spreadsheets, provided by ARB, associated with forecasts that they've made under their updated 2012 amendments, and in terms of sales projections that represented compliance targets for plug-ins, electrics, and fuel-cell vehicles that I've listed here by 2025 and again, scaled our baseline estimates of models within each of these technology groups and vehicle types.

We didn't, in our sort of reference forecast, broaden dramatically the penetration of these three technologies into every vehicle class, trying to be at this point mindful of where we think those vehicles are likely to show up, and a little less certain -- or certain that they're less likely to show up in other segments of the fleet.

And that sort of summarizes what we've done in largely putting together an initial set of forecasts based on work, relevant work that others have done.

And I'm going to show a series of slides here that are sort of the big keys. The first set here focused on our forecasted fuel economy improvements for passenger cars by key technology group.

Again, we're in this untenable position of the screen not having the figure be large enough and the hardcopy not being in color. So, I've learned next time I present I'll used dashes, and dots, and solid lines.

But the lowest line here is the forecasted fuel economy for internal combustion engine passenger cars.

And as I've noted at the bottom, I've identified the increases projected largely from the NAS study for each of these key technology categories from 2010 or '11, out to 2035.

You can see, if you look carefully, consistent

with what I'd mentioned earlier, that they begin to flatten out beyond 2025, reflecting the fact that there's no additional policy forcing in this particular case beyond that model year.

And CNG essentially tracks the gasoline ICE line because on an energy equivalent basis, which is the way we passed information to the consumer choice model, they're essentially the same for fuel economy.

There's a similar plot for light trucks. It shows very similar trends, except in each case, for each technology the relative benefits between 2035 and 2010 are somewhat muted because the light trucks have different utility uses where the benefits of some of the technologies that show up more efficiently in the passenger car fleet don't pervade the -- or permeate the entire light truck fleet. In particular, with respect to towing for certain light trucks.

Now, I'm going to show a couple of slides on prices. And the first one, again, is passenger car prices. And you'll see that there's a sort of a convergence going on. At the bottom we have the gasoline internal combustion engine, passenger cars.

And going upward from there is CNG, hybrid electrics, fuel-cell vehicles and then a combination of, I think, plug-ins that show up sort of separating from

the fuel cell line in the beginning, and battery electrics on top.

And what's going on here, as I alluded to with the technology penetrations, manufacturers are putting more technology that's fairly mature, relative to battery technology, into the IC engines, and you're still getting some nominal price rises for the passenger car -- or for the internal combustion engines.

For all of the other technologies there are nominal or varying amounts of decreases that reflect the learning or phase-in assumptions of battery and motor costs for these particular technologies contained in the NAS work.

Similar plot for trucks that, again, shows some differences from the passenger car fleet and, again, show the more dramatic reductions from the baseline for battery electrics and plug-ins, generally, and slight increases for the internal combustion engine light trucks.

And again, as I've alluded to with the fuel economy projections, everything is relatively flat beyond 2025 because of the policy assumptions that went into these cases.

That concludes my prepared slides and remarks. I can take questions from the Commissioners and, at

folks' discretion, can answer specific questions about improvements that we're planning in the final version.

COMMISSIONER SCOTT: This is all really interesting information. Thank you so much for coming to present it to us.

I was wondering, I was actually thinking about this and what these scenarios might look like outside of the light duty. And that may not be your area of expertise, but with medium duty and heavy duty trucks it seems like some of the assumptions that might go into here might be very different. And I wonder if you have a sense of what those scenarios may look like?

MR. CARLSON: I don't have a -- I will agree with you that they're different. And we've just not yet focused on looking at that sector of the fleet. But there are certainly differences that deal with the uses of the heavy duty fleet.

You know, you can't put a battery electric vehicle in a long-haul truck based on what we think technology's going to look like for that case for a number of years.

So, there are key differences and as we transition to incorporating the heavy duty sector of the fleet in future versions of our forecast we certainly need to be aware of all those issues, and there are a

number of them.

COMMISSIONER SCOTT: Okay, thanks.

COMMISSIONER MC ALLISTER: I don't have any questions, thanks.

MR. CARLSON: I'll turn it over to Jay for -- Gary, I'm sorry, for a history lesson. My apologies.

MR. YOWELL: Great, thank you. Well, good afternoon. I'm Gary Yowell. I'm front the Reporting Unit and there are -- oh, what am I in, the Fuels and Transportation Division.

One of the Energy Commission's roles is to provide market -- to make energy policy recommendations based on relevant objective information and analysis.

Now, I'll show you some of the empirical evidence we have that we used to measure the performance to date, and how we'll use that to influence our future policy recommendations.

Now, there are many various State and local goals and objectives, and these are the few that I'll be discussing here.

The Energy Commission has an Analytical Unit, which is the unit I'm in, and we're charged with measuring the performance and providing a basis for assessing the successful achievement of our mission and our goals.

And in doing this we look at about eight different agencies' data, and compile that together, and analyze how we're making progress towards our goal.

And here's a listing of all the various agencies' data that we use in the analysis, plus the knowledge that we've gained over the last ten years of performing the analysis.

Now, the analysis is pretty simple. The math is simple. It's simply the vehicle population, as provided by the Department of Motor Vehicles, the vehicle miles traveled as determined by the Bureau of Automotive Repair Smog Check Program, divided by the fuel economy that the USEPA Fuel Economy Guides give.

And all of that should equal the fuel sold as according to the Board of Equalization for diesel and gasoline fuel sales, or the utility sales, or ARB estimates for E-85, for example.

The complexity is that we apply this for 25 different vehicle classes and 30 different vehicle models -- I mean ages, over ten different fuels. And at the end of the day all of this must add up to the gallon of fuels reported sold for the various fuels.

One of the complexities that we see is, you know, as vehicles age they drive less, statistically speaking. The Bureau of Automotive Repairs gives us

this information from their Smog Check Program, and this is applied to each of the various 15 or 18 years of vintages that we look at. And it varies with the fuels, whether gasoline, or diesel, or electric vehicles, or whatnot.

So, the results, this is just to illustrate two concepts, as I go forward. One, there's a long history of a high correlation between human population and energy demand, prior to 2005 I must say.

And secondary, the purpose is to show that, and this slide is to introduce the concept of measuring fuel demand relative to historic demand trend line. This recognizes future population growth for California.

This is just to show the classic 55 years of on-road diesel demand, which has followed a fairly consistent growth curve absent the recent recession period.

And here I've added in the alternate fuels and alternate diesel -- alternate vehicles and alternate diesel fuels' contribution to diesel demand in the top dashed line.

And we have four months of historic sales in 2013. And if that pans out for the rest of the year, we will see a 4 percent uptick in diesel sales in California. And that would be consistent with the

historic 55-year trend line.

Per capita demand for fuel has been fairly unchanged since 1978. It continues this downward trend. The recession has accelerated that for diesel demand and for gasoline. But, historically, we have an upward rising diesel demand and that's because of the migration of older, gassing, heavy duty trucks are still evolving to diesel.

Now, we have a -- as we measure progress to our 2020 petroleum reduction goal, shown here in blue and red, blue is the growth period in California, red is the declining period in California. The purple dash on top is the alternate fuels and petroleum reduction technology's contribution to petroleum use in California.

Now, what we see is in 2012 we see an unprecedented 6 billion gallons' reduction in fuel use from the historic trajectory line. And we're well on our way to hitting our 2020 goal, which will represent about an 8.2 billion gallon reduction for that trajectory line.

COMMISSIONER MC ALLISTER: A quick question.

MR. YOWELL: Yeah.

COMMISSIONER MC ALLISTER: Do you have a sense -- I mean it seems like, you know, the linear

projection in this case, given the recession and kind of the unique nature of the last few years it kind of could go either way. You know, and if you look back you see kind of smaller oscillations around that bottom out during recessions, essentially, you know, late 70s and early 90s.

You know, I would love to think that our policies have, you know, pushed this and we'll continue to go down and we'll get the 8 million reduction.

But, you know, what's your sense of how much of this is still related to the economy? And if the economy really comes back, you know, barnstorming is -- you know, what's the possibility that this could turn upward again and sort of head back toward the linear.

MR. YOWELL: Great. To that point, I've quantified the -- looked at basically 24 factors.

COMMISSIONER MC ALLISTER: That was a great setup, wasn't it?

MR. YOWELL: Thank you very much.

So, I anticipated that question about three years ago, when I started this.

And so, remember I said we reduced from that metric of 6 billion gallons' reduction in 2012, and there you can see 6 billion gallons in 2012.

So, here I've identified the component. So, the

bulk of this, well, the blue is the ethanol blends' contribution, which is 5.7 percent ethanol to 10 percent ethanol in the later years. Yellow is the consumer shifting to higher fuel-economy vehicles.

You can see in the early years they weren't shifting to the higher fuel-economy vehicles and they flip-flopped in 2005 due to high fuel prices, some would say, and there's good evidence to support that.

The green is the reduced vehicle miles traveled from gasoline and the gray above it is the reduced diesel miles traveled from diesel, the diesel segment of fuels.

So, then there's all these alternate fuels and petroleum reduction options at the very top, which you can't see, and I'll show you later.

So, to your question, of the yellow bar I see -- excuse me, no, of the gray and the green bars, I see that is a component of the recession. And I've estimated half of this green bar, 42 percent of that green bar's contribution is due to lower birth rates which, and too is respective to the recession, as well.

So, at least half of that green and all of that gray I would expect to be in the future diminishing. I would hope would be diminishing.

COMMISSIONER MC ALLISTER: So, just to make sure

I understand here, prior to 2005 the negative yellow box is decreased fuel consumption by fleets?

MR. YOWELL: By the entire California vehicle purchases.

COMMISSIONER MC ALLISTER: Purchase, oh, okay.

MR. YOWELL: People were buying larger vehicles, more powerful than prior years.

COMMISSIONER MC ALLISTER: Okay, so we took a step back and then we sort of got on sort of the other side of that equation as of 2005?

MR. YOWELL: Yeah. If I had overlaid fuel prices, it would be very apparent why people shifted.

COMMISSIONER MC ALLISTER: Yeah, okay.

MR. YOWELL: Yeah. And so moving -- as a close-up view of the 11 items that you couldn't see at the top, here I've broken them out and here you can see the electric -- excuse me, the diesel vehicles and the hybrid, gassing hybrid conventional vehicles, we would call them, at the bottom. And they're contributing 3.7 percent of the total 6 billion gallon reduction in the year 2012.

And all of the alternate fuels combined contributed 2.9 percent to the 6 billion gallon reduction occurring in 2012, as well.

You can see heavy-duty natural gas, a very

significant contribution.

Yellow is electric vehicles' contribution and everything in between is all there.

And so we track this every year, from here on out, I believe.

Oh, let me back up one slide here. The yellow, I wanted to explain this yellow a bit. People buying higher fuel-economy vehicles has -- this is the most significant factor that occurred in 2012, but it is also three sub-factors combined here.

One, people buying new vehicles bought a smaller vehicle. We can see that in the data.

Two, we see the manufacturers improving the fuel economy of their vehicles, the same classes and makes one year to the next. And that happened in the latter part of the years.

And three, we see people with the existing vehicles on their driveway preferentially shifted towards driving the higher fuel-economy vehicle more than they did in the past.

So, all of these three factors are contributed here. And we're trying to quantify it, we want to tease out all three of those factors over time.

COMMISSIONER MC ALLISTER: And those are just in the yellow box is --

MR. YOWELL: That's correct.

COMMISSIONER MC ALLISTER: -- the yellow outlined in black?

MR. YOWELL: Yes, yellow outlined in black and green.

COMMISSIONER MC ALLISTER: Okay.

MR. YOWELL: Yeah, I started to quantify that but I had to abandon it because we got new data and so I had to stop and recalibrate.

COMMISSIONER MC ALLISTER: That's interesting.

MR. YOWELL: Okay. Now, all that historic data I showed you was based on this fundamental observation from our more complex analysis. And this is just a glorified spreadsheet analysis of the 27 million vehicles that are in California.

But if you look at the entire vehicle population in 2012, old and new, you would see the average of all light duty gassing vehicles on the road consume about 552 gallons and emit about 6.2 metric tons.

And if you compare it and contrast it to these technologies, which are reducing these volumes or that metric tons of greenhouse gas emissions. I'm showing ethanol flexible-fuel vehicle in an outlined shade because that is what the flexible-fuel vehicle would theoretically do if it was fueled 100 percent of the

time on E-85. But, in actuality, it uses ethanol 1.2 percent of the time, statistically speaking. So, it has a result way down there at the actual level.

Now, looking forward, as in the policy analysis perspective or program influence program, we would -- program influence mentality, we would be looking at forward new vehicle purchases. And this is the genesis of this technology.

This is showing all these new vehicles, as they were sold in 2012, fundamentally driving at 12 to 14 thousand miles, like a new vehicle does. So, this is a new vehicle acquisition performance, per se.

Again, we have higher values now. FFV is still showing the same way. We have the light duty diesel cars are shown two different ways to illustrate a point that applies to all technologies, mostly, which is that the diesel car can have zero percent biofuel and displace 274 gallons or 1.5 metric tons of greenhouse gas emissions.

Or if it was used on 100 percent biofuel, it would have three times the result of petroleum reduction and almost an order of magnitude higher of greenhouse gas reductions.

Now, this technology, this is just to illustrate the point that’s applicable to even conventional gassing

vehicles and all of these, except for the FFV which already has that built into it. And electric vehicles and fuel cells have that already applied based on Assembly Bill 32 compels higher renewability fuels in electricity, and we have other legislation compelling renewability aspects into the hydrogen fuel-cell vehicle fuels.

This is just to illustrate our new house, in-house capability. Thanks to Ryan Eggers of our Forecasting Unit we now have the ability to almost see, in real-time, new vehicle sales in California. We haven't had this ever before and this is really a great asset.

We have this for the national fleet in a month-in-arrears availability, but now we have this for all makes and models in California. This is really great to see. And this will greatly help our performance in the future.

And here I've applied the start -- looking at when all of these new technologies were introduced into California.

Would it surprise you to know that electric vehicles have been in California for 24 years? It surprised me.

You know, we've had their sales of hybrid

vehicles shown here and an interesting thing about hybrid vehicles, if you notice, this slope of this line is consistent with this 5 percent growth curve.

And what that means is that for any one of these technologies, whatever curve slope it starts on, if it maintains that for 20 years that technology will reach that percent of the market. So, the hybrid vehicles are five or six years into our 20-year track to get to the 5 percent of the market share for California.

Now, what's not shown here are plug-in electric vehicles; they're just in the middle of their third year of introduction. Had I showed them, they would be at twice the level of the natural gas on the third year, which is about 31,000 units, pretty significant.

And hydrogen fuel-cell vehicles, they've been introduced into California as of six years, now, and they are at 162 units. And so that's probably going to be consistent with -- that's well below the electric vehicles' population at that time.

In 2007 the Commission adopted a 9 percent alternate fuel use goal by 2012, and here I've summed up all of the contributing factors in an attempt to reach that goal. We missed the goal by about 360 million gallons. But you can see it's fundamentally made by ethanol, heavy-duty natural gas, and renewable diesel so

far.

And so in conclusion, in 2012 we saw an unprecedented 6 billion gallon reduction in petroleum fuel use, mostly attributed to reduced vehicle miles traveled, consumers shifting to conventional, higher fuel-economy vehicles, ethanol substitution, of course, and last, but not least, alternate fuels and dedicated alternate fuel vehicles.

Now, these relationships have been fairly consistent for the last 12 years, except for the consumer shift of higher fuel economy. That happened in the last seven years that's been consistently there.

And that's it.

COMMISSIONER MC ALLISTER: Thanks.

MR. YOWELL: The history lesson is over.

COMMISSIONER MC ALLISTER: Yeah, this is fascinating. So, could you go back to the vehicle trend graph; that one right there.

MR. YOWELL: Oh, sorry.

COMMISSIONER MC ALLISTER: Yeah, that one right there. So, I guess I'm wondering sort of like light duty diesels, a couple of them, like compressed natural gas here and light duty diesels you have the same time period, so 1992 to 2012. But there's 14 or 15 years shown -- there's a 20-year period, but there's only 15

years shown there for the light duty diesels. Is that just because they weren't selling many of them?

MR. YOWELL: Well, I've got light duty diesels in the two segments, the 1998 -- 1984, but I had a hard time splitting it out and having confidence.

COMMISSIONER MC ALLISTER: Oh, okay. Okay.

MR. YOWELL: Okay.

COMMISSIONER MC ALLISTER: So, you have -- so there's a green light duty diesels and then there's a red light duty diesels.

MR. YOWELL: Right.

COMMISSIONER MC ALLISTER: What's the difference between those two?

MR. YOWELL: The green 1992 diesels represent what they called advanced clean diesels. And I wanted to represent that with consumer behavior today.

COMMISSIONER MC ALLISTER: Okay.

MR. YOWELL: And the old one is the entire population of vehicles from the earliest records of DMV data that we have. So, it gets the old dirty diesels included in there.

COMMISSIONER MC ALLISTER: So, these are the old, clunky Mercedes.

MR. YOWELL: There you go.

COMMISSIONER MC ALLISTER: And the green line is

the new diesel Jetta, say.

MR. YOWELL: There you go.

COMMISSIONER MC ALLISTER: Just to not name names.

(Laughter)

MR. YOWELL: Yes, yes, thank you for using those terms.

COMMISSIONER MC ALLISTER: So, but if the newer ones came on line in 1992, wouldn't there be 20 years of data there? I'm just trying to kind of understand what the -- is it like would there have been a flat period for the first five years or so?

MR. YOWELL: Good question. Let me check into that.

COMMISSIONER MC ALLISTER: Okay. I guess I'm interested in the flat period before the ramp up occurs. So, how long, typically, does it take a new, promising technology that looks like it's going to have traction to actually get traction?

MR. YOWELL: Oh, yeah, and the hybrid is a really good example. You know, the classic S-shaped curve, like you can see that in the hybrid vehicle technology.

COMMISSIONER MC ALLISTER: Yeah.

MR. YOWELL: The light duty diesel had

government regulations that were impeding sales for many years and that's partly part of the flatland that you're seeing there.

And we're now at the cusp of a new, of a significant introduction of diesel cars. And we'll start seeing this in real-time, in the next two or three years we'll actually have the data.

COMMISSIONER MC ALLISTER: Yeah, okay.

MR. YOWELL: But it's mostly government of curtailment of sales because they were limited sales in California to 2004. And then sales just continued until 2010, here in California.

COMMISSIONER MC ALLISTER: And so that was limiting because of the particulates or some particular --

MR. YOWELL: For the NOx, the NOx standard was unattainable --

COMMISSIONER MC ALLISTER: The NOx standard, okay.

MR. YOWELL: -- and the emissions. And the fuel wasn't available until 2009 in California.

COMMISSIONER MC ALLISTER: Yeah, okay.

MR. YOWELL: So, all those things prohibited it.

COMMISSIONER MC ALLISTER: Okay, great. Yeah, that makes sense, thanks.

MR. YOWELL: Any other questions? Cool, I'm out.

MS. RAITT: Thanks Gary.

Our final speaker today is Gordon Schremp.

MR. SCHREMP: Good afternoon. My name is Gordon Schremp. I'm the Senior Fuel Specialist in the Transportation Energy Office.

And this afternoon I'm going to be covering our biofuel outlook. This is some historical information, as well as some prospective with regard to advanced biofuels.

Now, why advanced biofuels and other biofuels are important, something we do in the Commission, besides they're important transportation fuels in the mix, but we also look at other regulations, Federal and State, with regard to potential impacts on fuel supply and availability.

So, you've seen some of the initial forecast information come out this morning. We actually have some other work we perform on that initial draft forecast information and that is to see what happens when we achieve compliance with the Federal Renewable Fuel Standard and the State Low Carbon Fuel Standard.

So, what that actually does, it will change and modify those numbers, not necessarily for displacement

of petroleum, per se. It's really more of a matter of the types of biofuels being utilized.

So, we want to know where biofuels are and where they're going, and if there are any issues in particular, infrastructure issues that may, you know, temporarily prohibit or be a barrier to greater introduction of these biofuels.

So, I'll move on. And if I'm going a little too fast at points, I'll cover some of the slides rather quickly that aren't as important, just put a stop sign up and slow me down. I'll be happy to do that.

So, just a little laundry list of the ethanol, biodiesels, and advanced fuels I'll be covering this morning.

And the predominant one, of course, is ethanol. There's a lot of it produced in the United States, but it's been dropping off. And that's gone in conjunction with gasoline demand declining.

As you see here, in sort of a peak in 2000 and now coming off, it's down about 6 percent from that peak in the United States. So, that's rather significant. Not only are we forecasting decline in gasoline use in California, but EIA's forecasting decline in the United States, as well, for similar reasons. Primarily improved fuel economy of the existing fleet as time goes

by, and sustained high prices.

So, ethanol, besides lots of production, which is the lion's share of supply for our use, we do have imports. They can, over a long period of time, be cyclic.

Brazilian imports are something that's been important rather recently. That's to help meet and achieve compliance with the Federal Renewable Fuel Standard because sugarcane ethanol is an advanced biofuel under that regulation.

But we also export to some of these other countries. And we've sort of changed. We've shifted to a net exporter. That's because we have lots of capacity and we had ethanol plants operating and still able to successfully or economically export to some foreign countries, Brazil, some of them and up over to Europe.

So, we expect this kind of behavior will continue to some extent, but we think it's going to switch back to where we'll be a net importer.

Now, the reason is, is in particular Brazil. As you see, it's sort of a cyclic nature. We seem to get a lot in the latter half of each year and a little bit in the front half of a year.

There's a reason for that. Brazil, as you heard three weeks ago from the presenters in this forum, they

start harvesting April/May, so there's not a lot of available suppliers, it's tight and it's more expensive.

So, that's why imports coming to the United States in the latter half, in the larger quantities.

We expect this to be the same case this year and, in fact, we expect to see even more imports of Brazilian ethanol coming to California, especially to help meet the compliance with the Low Carbon Fuel Standard.

So, there's a lot, we're up to almost a record level of Ethanol use, almost 890,000 barrels per day, the most recent data available for the U.S.

But that is going to be close to what the limit is going to be because it keeps bouncing up against this red line. That's not an actual, fiscal red line, but it's a construct. It's referring to the ethanol blend wall. And you can use ethanol and gasoline for warranty purposes, distribution purposes at 10 percent by concentration in all states, and that's not an issue.

In some states you can go higher, but the majority of the states don't allow that without a change in regulations.

So, if you want to use more than 10 percent and you want to get more ethanol into the gasoline pool, you have to use two other means. E-15 sales, there's about,

estimated about 30 locations now dispensing E-15. But keep that number in mind with the total number of retail stations in the U.S., 156,000. So, that's a very small point at this juncture, but we expect that to continue to grow.

E-85 is at over 2,600 locations, 84 at least in California. And so we expect that to continue growing as well, but there are issues. There are limits either of warranty, pricing issues associated with E-85. So, going much beyond the blend wall is a challenge.

Now, if gasoline demand was flat, which it is not, it's declining, that's why if you're already at the blend wall and gasoline demand declines, then that means next year you can't even use as much in the marketplace.

So, this is why this is such a big concern for the Renewable Fuel Standard that we can't keep jamming more biofuel into the gasoline pool with gasoline declining.

So, USEPA has acknowledged this and will publish, soon, regulations or proposed regulations for next year where they will modify more than one category of the Renewable Fuel Standard downward. We will all wait and see what that is because we have to do post-processing analysis of our forecast to comply with Renewable Fuel Standard Regulations and now they're

going to change.

COMMISSIONER MC ALLISTER: What's the latest thinking on the technical implications of that, like the blend wall, you know, how far beyond it might we go and still not have issues with the existing stock?

MR. SCHREMP: USEPA has already telegraphed, if you will, and when they announced their 2013 Renewable Fuel Standard requirements, just published the final rule recently. They telegraphed that they will be targeting an ethanol blend wall when they look at how they have to reduce those standards downward, how far they have to go down.

So, they'll look at 10 percent blends. They won't look at E-15, really, but they'll see how much more E-85 you can use. Some ramp up of E-85, but it is modest.

And so then they will say how much do I have to lower the advanced category? How much do I have to lower the total renewable category down so that market participants are able to achieve compliance through physical blending of ethanol and not go beyond that 10 percent blend wall, and the additional E-85.

So, we will take that cue from USEPA and modify those standing, you know, 2007 ISA standards, down accordingly to match what EIA is suggesting is going to

be the gasoline and diesel demand projections over the near term here for their annual energy outlook under the various, you know, scenarios we're going to examine.

So, California, I think Gary mentioned this briefly we've had some sort of jumps in ethanol use. NTBE phase-out, the first one, then goes to 5.7 percent, and then finally get to 10 percent like basically everyone else. And that's gone down, like U.S. demand levels, because of a decline in gasoline use in California.

The reason I show this, I'm going to shift gears, and where is the ethanol coming from? It mostly comes from the Midwest. Why, plants are sited closest to the highest concentration of corn. That's the darkest green colors and all the red dots.

So, that's why we always talk about Midwest ethanol from corn because that's where the lion's share of the ethanol production in the U.S. is.

Now, corn has been going up in plantings because of the high prices. It's going to rather, but not a record high planting, but rather high. But because the yields are so much higher than they were years ago, and we're going to have the third highest yield, according to USDA estimates, we're going to have a bumper crop.

Now, I know there was a bumper crop forecast

last year in the early spring, and then the drought continued and basically killed the corn crop.

Not this year, there's been the reverse problem, too much rain, didn't quite plan this as timely as they wanted in some areas, and now they think there's some impact on the corn crop production, but still going to be a record. That's the point.

So, we use a lot of it for different purposes and one of the biggest growing categories of corn use of course is to make fuel ethanol. But this will level off because under the Renewable Fuel Standard you can't use more than 15 billion gallons in a couple of years, and then it's flat after that, from traditional corn ethanol.

But you see here a little bit of resurgence in feed and residual and that's because the total use went down and it's relative contribution is almost that to create fuel ethanol.

The only purposing of showing an ending stock slide, because this is the key driver for corn ethanol prices. How much will be in the inventory in those silos by the time they harvest the new crop August/September, early October?

This is the third lowest in this time period, going back to '76, and this low inventory forecast or

outlook by USDA is what's keeping corn prices so high. As you see, record high prices for corn.

And you say, well, does that increase my food cost a little bit? Yeah. But the biggest impact from a fuel perspective is it impacts the profitability of ethanol plants, that's their feedstock.

So, if ethanol prices are relatively stable or somewhat flat because there's a bit of an over-supply, you remember I said we did a lot of imports recently, then their profitability suffers. And that's what you see here with those blue bars getting very small, negative, and more recently recovering.

That's because the corn prices are starting to come down, ethanol's going up a little bit. The market knows we're going to have a bumper crop. As each month goes by and they see no bad drought-related, corn-related concerns, the corn price will continue to decline and this will improve profitability.

Why is that important? It will bring back some of the ethanol plants that are sitting there idle. They haven't been dismantled. They're just idle because some of them it's not economical to operate at this time, it's about 9 percent of capacity.

The same thing California, we have some ethanol capacity that's idle right now, but we expect that to

come back when these economic conditions improve.

So, switching gears to Brazilian ethanol, it's going to be a very component in the U.S. and especially in California for compliance with the Low Carbon Fuel Standard because its carbon intensity is better than that of corn, better than that of California facilities, and in some cases with co-generation and mechanized harvesting quite low.

But there is a difference; a quick comparison and contrast, a lot more ethanol production facilities in Brazil, but they're a lot smaller, and they produce more ethanol per acre than through corn.

But everyone knows, you know, sugarcane is, I think, better at producing on a per-acre basis than corn.

So, this shows two different types, hydrous with some water anhydrous with not -- we use anhydrous in the United States because that's what you can blend with gasoline.

However, as you heard three weeks ago, Brazilians use a lot of FFEs and their FFEs can handle not E-85, but basically E-100 that can be hydrous. So that's why the hydrous volume's going up because they're using a lot more FFEs in their existing fleet because that's basically all they sell.

So, this will continue to go up. Anhydrous can also be used, shipped to Caribbean basin-initiative companies, dehydrated and then shipped to California. And that is also a low carbon intensity fuel for use.

And this is just saying most of it's in south central and that's where basically all of the increases come.

Exports; very important if we think U.S. and especially California's going to depend on this kind of ethanol for a period of time, and the point here is that near-term forecasts of exports are quite high, 3.2 billion gallons two years from now. And that's, you know, double, more than double the record export from Brazil in 2008.

So, certainly achievable with the increase in acreage of sugarcane and some plant processing capacity, so we hope this comes to fruition.

However, even if it doesn't, we're not banking on incremental exports of having to be there to get enough Brazilian ethanol. We think that you can ship U.S. ethanol down to Brazil, as has occurred over the last couple of years, and you can send Brazilian ethanol to the United States and California.

So, we don't see this as a capacity concern because you can do some switching, if you will, between

Brazil and the U.S.

So, we don't see a problem, really, for this type of traditional ethanol from cane coming to California in terms of just total volumes available.

California, from an infrastructure perspective, we have ethanol from three sources. The bottom bar is our own ethanol production facilities, which you see have come up rather dramatically recently.

And marine imports, that's from Brazil and Caribbean basin-initiative countries. And we expect that green component to increase. We expect the bottom component, the red component to increase in California, two important sources of low carbon biofuels, and then the rail component can decline.

The only exception to that scenario is if there's infrastructure developed in other parts of the country that can receive Brazilian sugarcane by water, put it on to rail cars and then send it to California. There isn't an infrastructure problem associated with that kind of movement because we already receive a lot of ethanol by rail.

And in fact, if you go back to 2010, we receive a lot more ethanol by rail than we did in 2012. So, that infrastructure is in place and it's primarily unit train movements.

So, all the retail, all the distribution terminals can blend ethanol as they load the gasoline. This is not a problem.

And even if we were to move to an E-15 or start a transition to E-15 blends that will not begin for at least three to four years, that's what the Air Resources Board says is the time required to modify the regulations to enable that to occur.

But we think there is some room at these distribution terminals to cycle those tanks more quickly, greater loads of volume over unit time. And so, modifications to handle a slow ramp-up of E-15, beginning three, four years from now, shouldn't be a problem.

Rail logistics, as I mentioned there could be some rail, marine, rail, you know, starting in Houston and coming here. We don't think that's going to be a problem at all.

And we used, you know, quite a bit in 2012, 82 percent, but that was less than it was in 2010.

Marine facilities, this is an area of potential concern over the near term. It's already an issue raised by some stakeholders that it has constraint. They wanted to bring in some marine ethanol and they're having difficulty finding a location to do something

like that.

So, this is an identified potential constraint that is more than just this one example. So, we're going to be -- we're surveying people to see what kinds of biofuels they're going to be bringing over the near term here, in particular where in the infrastructure they're going to bring these biofuels and what volumes. That's the important aspect of it. So, we should have that information back to us in a couple of weeks, before we start our analysis.

So, biodiesel production, a record level we're forecasting for this year, after all the Federal RFS requires 1.28 billion gallons this year, but some of that will be met with credits, excess credits from last year that can be applied to the Federal program.

We don't export a lot of it. It's a smaller amount, certainly from the record in '08, because European Union put a tariff on because they said you guys are getting a dollar a gallon blender's credit. That's not fair for competition. And so that really put a kibosh on, I think, exports to Europe.

We use a lot of it. It goes in cycles. It goes up, it goes down, it goes up, it goes down. What's up with that? Well, that's winter. There are some cold poor point issues with most traditional biodiesel and so

there is less utilized in the winter months.

And then, certainly, as you get away from winter that's not a problem. And so that's why it's sort of a cyclic nature here.

But we expect the biodiesel demand to continue growing. And here we're already over 2 percent, here in May, in the United States on average.

In California we're less than that. Our biodiesel use is not 2 percent. I think it's a little less than 1 percent. And that's an issue associated with not as much infrastructure to blend biodiesel into the diesel stream as can be done because, clearly, there's no problem by using biodiesel in a concentration of up to, you know, 5 percent by volume. There isn't any air quality or there aren't any warranty issues associated with that concentration.

So, here you see that it's jumped up recently. We expect this to continue growing, and rather significantly, because if you can actually get to a B-10 blend over a couple of years, two to four years in California, that's roughly 350 million gallons, much more than this, but it would be a very important element to help achieve compliance with the Low Carbon Fuel Standard.

Because biodiesels made from things like corn

oil, this yellow bar, are very low in carbon intensity, 4 grams per megajoule compared to something like soy, which is, you know, almost 90, and our regular diesel's 98. So, that's why corn diesel, biodiesel's very, very important, as some that's made from white and poultry fat, and used cooking oils.

So, it's good to see that utilization of these feedstocks is growing. Used cooking oil, dotted green line, corn oil, dotted red line, they're growing in the United States because in part soy prices are pretty expensive relative to these fuels and that has made these other products more desirable as a feedstock.

Also want to point out that in many instances a used cooking oil biodiesel plant is in a location and collecting their feedstock from local restaurants. And in many of those cases they do not have access to rail.

So, it is -- if, for example, we're looking to obtain used cooking oil biodiesel from facilities located in the northeast U.S., upper Midwest, it's unlikely that they would be able to competitively provide that in California.

We certainly know all of the used cooking oil that's being converted in California will go for the LCFS market, and material in Oregon and Washington the same thing.

But just pointing out that, yes, there's a feedstock supply of used cooking oil, but plants are being sized to accommodate a local restaurant, hundreds of restaurant, and collecting -- the collection system is very sophisticated in many cases, and very beneficial in keeping that material out of disposal system, get a higher value use of this material and helping the restaurateurs deal with this waste.

COMMISSIONER MC ALLISTER: So, I have just a couple of questions. So, I was surprised at the difference between corn and soy. And is that because you're talking about corn that's a byproduct or a used corn oil, or as opposed to freshly minted soybean oil? I mean is that the reason for that disparity in price or is there something else going on?

MR. SCHREMP: I think with -- I think I have a previous --

COMMISSIONER MC ALLISTER: A couple of slides ago, I think.

MR. SCHREMP: Well, I think I'll jump up here. There is some -- here's some prices of soy and corn oil. And you see corn oil has been a little bit lower. But to your point, corn oil there's two different kinds. There's refined corn oil, a very high purity that's used in cooking oil, then there is an unrefined corn oil.

And that's something that biodiesel producers can utilize.

COMMISSIONER MC ALLISTER: Okay.

MR. SCHREMP: However, there's some byproducts they have to remove, some processing and handling. So, the price differential can be -- it could be discounted 25, 30 percent from that refined corn oil. And these are refined corn oil prices here, used in this chart.

COMMISSIONER MC ALLISTER: Okay. Yeah, I guess I thought I heard that it was something like 4 bucks and was it 4 and 7 bucks.

COMMISSIONER SCOTT: Yes, that's the standard.

COMMISSIONER MC ALLISTER: Oh, okay. So, could you go back a couple of slides just to -- let's see, that one right there. So, that's less. The previous one, I guess. Yeah, so --

MR. SCHREMP: So, these are basically all of the different oils that were used to create biodiesel and soy clearly the dominant one. In fact you have, in many cases, large soybean processing facilities --

COMMISSIONER MC ALLISTER: Yeah.

MR. SCHREMP: -- where the biodiesel plant is taking that oil and selling it.

COMMISSIONER MC ALLISTER: Yeah.

MR. SCHREMP: So, the other oils are far less in

quantity. But it's some of those other oils that we believe will be a disproportionate share of the biodiesel used in California.

Because under the Federal standard, indifferent to how you create the biodiesel. It does not matter if it's soy, it doesn't matter if it's palm, it doesn't matter if it's corn.

So, compliance by companies outside of California to meet their RFS-2 obligations, they will be indifferent and they will be seeking out better price points for biodiesel.

But in California not the case, you really don't want to use soy. And as time goes by in the next two, three, four years, you're going to want to use soy biodiesel even less.

COMMISSIONER MC ALLISTER: Okay, so I guess a complementary question that I have had is, you know, we've funded quite a bit of stuff through AB-118 and, you know, some really great projects to get California producing more biodiesel through a variety of means, and a lot of it is collection. You know, sort of setting up the infrastructure to set and refine the used oils, tallow, and poultry fat, and all that kind of stuff, in addition to some agricultural production innovation projects.

So, where if -- let's say we, you know, just put out the -- we were able to capture virtually all of these streams, these byproducts streams in used cooking oils and stuff like that, you know, what percentage of that is going to really -- how big is that? What's the scale of that system that we could possibly achieve versus the sort of potential consumption for all of the production there?

MR. SCHREMP: We can get back to you with some specific estimates by feedstock for California but --

COMMISSIONER MC ALLISTER: I'm trying to sort of gauge how much of this solution this is, yeah.

MR. SCHREMP: I do recall it's in the area of 100 million gallons in California, thereabouts.

To put something in perspective, the Diamond Green facility, the Valero project in Louisiana uses animal wastes and used cooking oil as a feedstock. It's 142 million gallons per year production facility for renewable diesel.

They, on their website, state that they gobble up 11 percent of those two sources of material from the United States of America.

So, if you put that in perspective and you say, well, I want to capture it all I could build eight more of those plants. But that would never occur because

it's escalating cost as you go further afield to try to -- your gathering costs go up for fewer gallons, so we don't think that's going to happen.

So, yes, we think there's probably 100 million gallons, hopefully 200 million gallons that could be brought to bear. And that's why, and I'll get to it in just a minute --

COMMISSIONER MC ALLISTER: Okay.

MR. SCHREMP: -- we can look at exports of oil and say, well, don't export it, actually convert it to a biofuel that has a very low carbon intensity. And so it is an option and we're not taking up other domestic uses.

COMMISSIONER MC ALLISTER: Right. Okay, thanks.

MR. SCHREMP: So, there's plenty of biodiesel to meet the Federal standard of 1.28 billion gallons set for 2013. We believe USEPA will likely gradually increase this over time.

As you can see, a conservative estimate by EIA, and these are not just an estimate by EIA, they collect data from 116 biodiesel producers every month. So, they track who's operating and what the volume is, and they tally up those numbers.

So, not quite 63 percent utilization rate for these facilities so plenty of spare capacity. There is

at least 800, 900 million gallons of idle, shut-down facilities not even in this list of 116. So, there's lots of ways to go with biodiesel. So, there's plenty of, I think, production capacity in this country.

But corn oil, used cooking oil, animal fats, lowest carbon intensity materials that we think are going to be very desirable and necessary in California.

So, this is just showing you, taking the soy away, here are the pounds in corn oil, a big component, others are remaining oils. Sunflower not, and peanut we don't really utilize. Canola some, yes.

And so back to my point, exports, one example corn is exported. And corn oil conversation to biodiesel, it's about a third of all uses of corn oil in the United States, currently. And this is of domestic use, now excluding exports.

So, the red line and the right-hand access represent the potential to convert that export material into biodiesel, so it's rather significant.

Once again, 350 million gallons for California would be 10 percent. So, 175 is 5 percent. So, there is enough material, it's just do the economics and do the facilities, you know, have time to do that.

So, this is just showing that biodiesel, when you look at these two feedstocks, is expensive before

you have any capital recovery, operating costs, pay your employees. It's expensive, hence the importance of a dollar-a-gallon producers credit under the Federal program.

So, this is when that credit goes away, biodiesel facilities go idle, many of them. And when it comes back, they come back.

So, it is an expensive material. But more recently under the Federal program their currency for demonstrating compliance is their renewable identification number, or RIN. So, you may have read or heard about RIN prices being very expensive, over $1.40 a gallon.

Well, RINs go with the biofuel. They stay with the biofuel until you blend it with the diesel, in the case of biodiesel, or gasoline in the case of ethanol. So, those RINs have economic value, by far.

And so the creators of biodiesel know that, they get the dollar and they have this RIN that has that kind of value that they can sell to an aggregator or sell to a refiner who needs this currency to demonstrate compliance with the USEPA, because a biodiesel producer is not an obligated party under RFS-2.

So, our capacity for ethanol production in California, for biodiesel production in California is a

little bit less, our utilization this time 50 percent. But we're using a greater amount of these used cooking oils and animal fats from the data we collect from the producer.

So it's good, expect to see more and we can get some numbers for your, to your question, Commissioner McAllister.

So, I think a final point, B-5 blends we think we can go to in a couple years. Infrastructure at the distribution terminal needs to be upgraded. There aren't enough terminals that are dispensing or able to dispense biodiesel at this time. That's something we're going to be documenting, what those numbers are.

But with regard to how much you could use, there is a light duty warranty issue that usually is limited to B-5.

Heavier duty you can go higher. And so, clearly, we use a greater quantity of diesel in heavy duty applications, so this is a market where you could fit more biodiesel into the overall pool and not into, necessarily, the Mercedes.

And if you go beyond B-5, you have labeling issues at pumps that the market participants have talked to us about, and I look at that and go, well, aren't those just stickers? What's the big deal here?

But to go beyond that, there is a potential NOx issue that needs to be mitigated and the ARB and stakeholders have been working very hard on this for a long period of time. And we expect in October ARB will roll out their final rule on how those mitigation strategies will enable greater blends of biodiesel than the 5 percent, so that's good news.

Advanced biofuel production very modest under the Renewable Fuel Standard, and in this context I'm not talking about advanced, say, sugarcane ethanol, I'm talking about like cellulosic fuels, advanced biofuels that have greater greenhouse gas reductions. They've been small, not even 100,000 gallons since 2012.

You look at other things, such as the other cellulosic biofuels and that's cellulosic diesel fuel is what we're seeing, starting to see some of the earliest come out in this 46 million gallons, so a lot more here.

But cellulosic biofuel production is small so we want to see where is that going because cellulosic biofuels are important for the Federal program compliance and they're very important for Low Carbon Fuel Standard Compliance.

So, they have very low carbon intensities and so we're very interested in what plants, where they stand.

So, this is from *Biofuels Digest*, they have a

very nice list that they update periodically. E2 has done some great work in this area pulling together a list.

But I think the *Biofuels Digest* is good in terms of it lays out the technologies and the volumes by year. So, this is something good to look at this, so we do some additional deep diving, due diligence, if you will, and say, okay, those are the raw numbers and the plant list. Let's go through and what's under construction, what's operational, and what's planned that has money, permits, or site location and permits either in hand or, you know, are imminent. And when you do all that, the numbers drop by -- you know, from 2.5 down to 500. So, there's a significant modification.

But this is not unusual. You go back a year, you go back two years, you go back three years on these lists and you'll see lots of facilities on there.

And for newer technologies, as you were talking about earlier, Commissioner, yes, there's a lot of extensive research and development, pilot demonstration facilities, but we don't include those in facilities that have fuel for the marketplace because USEPA does the same thing. They don't include that material as being available either to submit to the program and/or sell to obligated parties. So, we've taken the same

approach as USEPA here.

So, these are end-of-year volumes, after we do our due diligence, and most of it is drop-in diesel, renewable drop-in fuel, diesel variety.

This is the Diamond Green facility in Louisiana. So, by the -- so, if you look at 2013, you could say to yourself that can be available for 2014. So that's why you look at USEPA and they say very small quantity of cellulosic biofuels, and that's why it's only 6 million gallons is the standard this year, instead of 1.0 billion gallons as Congress had set back, you know, in 2007.

So, there is a slower ramp up issue with regard to cellulosic biofuels, but there is big -- there are big increases coming very soon. So, this is good news.

And I think another takeaway is that drop-in diesel is making a lot more progress than drop-in gasoline. You see a little bit of that by the end of 2017, from our list here. So, that is a little tougher nut to crack, so to speak.

But these diesels, either some advanced renewable diesels, using low carbon feedstocks are actually breaking up cellulosic material and turning them into diesel jet and gasoline components, besides the ethanol that's in the red there.

So, we put our list up and we like to be transparent, if at all feasible, and we like people to give us information and say, hey, you missed this facility, you missed that facility, or that one's no longer planned, please remove that from your list.

So, it should be a living database, that's our intention here and we want to update this.

And once again, you know, we haven't included every single demonstration pilot facility on this because, once again, not going really into the marketplace.

So, the high points, operational, commercial scale, cellulosic facility underway in Florida.

Good news, Diamond Green drop-in diesel and KiOR cellulosic gasoline and diesel, mostly diesel, the share is mostly diesel at this point. So, good news, operational and then others under construction, so 2014 will see a lot more coming online, so that's good news.

So, I think I've covered all these points and I'd be happy to answer any additional questions you might have at this time.

COMMISSIONER MC ALLISTER: I think I'm good. Thanks very much, that was a fast, but very -- very good stuff.

MR. SCHREMP: You're welcome.

COMMISSIONER MC ALLISTER: Thanks.

MS. RAITT: Thanks Gordon.

I think we're ready to open up for public comment. So, if there are -- actually, we had one gentleman who -- Robert Sawyer from UC Berkeley, please.

MR. SAWYER: Commissioners Scott and McAllister, thank you so much for holding this workshop and allowing me to participate.

COMMISSIONER MC ALLISTER: Can I just -- can I thank you for being here? I really -- I want to just acknowledge Robert Sawyer as a former Chair of ARB and just all-round knowledgeable expert on many of the issues we've been talking about today, and also a super nice person, which is not low on the list of things that I appreciate.

And so thanks for coming here. I just wanted to acknowledge you. Before you actually introduced yourself, I wanted to just say thank you for being here, it's great to have you.

COMMISSIONER SCOTT: Second that.

MR. SAWYER: Thank you for the kind comments. I'm a Professor of Energy Emeritus at the University of California at Berkeley, former Chair of the Air Resources Board, a Board Member of the California Lung Association. And I think most importantly to this

session, a member of the National Academy of Sciences' Committee on Transition to Alternative Vehicles and Fuels that prepared the report that Tom Carlson drew upon, largely, for his study.

The good and bad news about personal vehicles is that they're extremely inefficient, with maybe a couple of percent of the fuel energy being used to move people around and the rest being used for other things.

The good news about that is that there are tremendous opportunities for improving the efficiency.

I've certainly seen that in my lifetime. The first round of CAFE standards roughly doubled the fuel efficiency of automobiles. The 2025 standards, brought in place by the Obama Administration, are going to double the fuel economy again.

And, you know, I fully expect that there will be yet another round which will double fuel economy again. It's well within known technology to do that.

The charge of the National Academy Committee was to examine the possibility of reducing petroleum consumption in the light duty vehicle fleet by 50 percent by 2030, and by 80 percent by 2050, and also by 2050 reducing greenhouse gas emissions from the light duty fleet by 80 percent.

Okay, we examined technology, and fuels, and

policies, and all three we concluded were essential in order to meet those very ambitious goals. But I will speak primarily to the technology part of it.

Two sets of technologies were proposed, those labeled as optimistic and those labeled as mid-range. Mid-range was sort of what would happen, I think, without too much effort. Optimistic means pushing known technology into production to accomplish improved fuel economy.

All of the technologies were demonstrated technologies. No breakthroughs were required, no new research, even including through 2050.

Much of the gains was obtained through improving vehicle efficiency, largely by reducing weight. But even there the weight reduction was through use of high-strength steel, some aluminum, a little bit of magnesium, better design strategies. No carbon fiber technology at all was considered.

We felt that it was just too uncertain about what the costs will be and about what the manufacturing capabilities would be for carbon fiber, but you may have noticed that BMW is producing vehicles with carbon fiber body components at the present time. So, that technology is moving, I think, quite rapidly.

They have built a large carbon fiber plant at

Moses Lake, in Washington, to take advantage of the low-cost electricity there.

Substantial drag reductions, these also are occurring in current vehicles.

Rolling resistance reductions and accessory efficiencies improvements, all of these things just reduce the requirement on the power plant and allow great efficiency improvements.

Also not considered were information technology available and coming into place to improve the efficiency of the transportation system.

And by this I mean vehicle-to-vehicle communication. We see that already in collision avoidance, automatic break application, that sort of thing.

But this technology can also be used to improve vehicle flow on freeways.

Vehicle-to-infrastructure information, information on where traffic jams are occurring transmitted to vehicles much more efficiently so that people can select their routes.

Adjustable speed limits so that maximum flow can be maintained.

But any number of things which the transportation engineers are working on and trying out.

And finally not considered was any form of autonomous vehicle. And we see that moving along rather rapidly now. One is not clear whether that would improve or destroy fuel economy. It might just allow people to use their cars a lot more, sending your car to the grocery store to pick up a loaf of bread, without you in it, might not be such a great thing for fuel consumption.

But anyway, that was not part of our technology.

COMMISSIONER MC ALLISTER: Will we have to form relationships with that car or I don't know, you know, sort of sending your mascot.

MR. SAWYER: Well, it's a technology which, you know, has a place and I certainly see it coming, although it's pretty hard to predict when or just what form it will be.

COMMISSIONER MC ALLISTER: We could build a hyper loop for the gallon of milk, right, just send it over to our house.

MR. SAWYER: Some general observations about the technology part of our studies, battery electric vehicles are -- the technology is here, the vehicles are in production. They are good vehicles, performance is limited. And this will probably remain the case. Performance is limited because batteries are heavy and

expensive. They will get better. But one expects the battery electric vehicles, with the exception of some very high-performance sports cars, expensive sports cars, will have limited range and face a problem of refueling time, which is there is no obvious solution in place, yet.

Although, rapid charge at less than half an hour is certainly something which Tesla is putting into place and, you know, maybe people want to stop and get an In-and-Out Burger and get recharged at the same time.

So, I think that there's a limited market for battery electric vehicles, maybe 10 or 20 percent in California, which is an important contribution in many ways, especially to air quality.

Plug-in hybrid electric vehicles, I think you would have to go far to beat the technology in the Volt and other vehicles that are coming along like that. Here's a vehicle which can substitute electricity for gasoline, depending upon how the owner decides to use it. It works well, it's a full-performance vehicle, full-range vehicle and we can certainly anticipate lots of those coming into the marketplace as part of just the general improvement in hybrid electric vehicle technology.

And, finally, the technology of the future I

believe is the fuel-cell electric vehicle. The reason a new technology can transform the automobile industry is that it would be better and be cheaper. And the fuel-cell meets both of these requirements. We're in our second or third generation of automotive fuel-cells now. The prices are coming down rapidly. The weights are coming down and the performance is going up. Just about all the barriers in the fuel-cell, low temperature operation, for example, all of these things have been solved, the technology is there.

Industry worldwide, the auto industry worldwide is in second or third phase of development. They all have demonstration vehicles on the roads, total numbers now in the hundreds, soon to be in thousands. So, the technology is ready to go.

And our study indicated that combined with the improved vehicle efficiency that these vehicles will be better than the IC engines which they will replace. And not only that, they'll be cheaper. That the IC engine is really complicated especially when you push its efficiency limits and reduce its emissions to 99.9 percent of what they used to be, which I think is what the Air Resources Board is planning for the next round.

So, this is a technology that's going to be cheaper.

Hydrogen has many attractive features. It can be made from many different sources, some of them low carbon, some of them not low carbon.

Its distribution is the big problem, especially the infrastructure for selling it. But eventually it can be piped around, just as we pipe natural gas around, although, the initial sales will probably be from distributed generation systems, a variety of them.

Storage, because of the improved efficiency of the vehicles, the amount of hydrogen you need to store on a vehicle to get a 300-mile range has gone down dramatically, so the storage problem has become a lot less.

And I think that technology has also been pretty much solved with 10,000 psi storage systems. So, all that's needed is a distribution system and California certainly has an opportunity to play a major role in making that happen.

And if you have any questions, especially about the Academy Committee report, I'd be glad to answer them for you.

COMMISSIONER MC ALLISTER: I really appreciate your comments, very concise and informative, which is terrific.

I do have a couple of questions, actually. So,

during the course of our presentations from staff and others I was kind of wondering, you know, where -- thirsting a little bit for sort of what's the radical new technology that can provide us a sort of real aggressive scenario. You know, absolutely we have to start with kind of the projections from the past, you know, incremental improvements. And I think we saw some of that in the gradual upticks of efficiencies in some of the graphics there.

But, you know, the Hypercar discussion that Amory Lovins was pushing a few years ago, the radically light-weight cars, the sort of hyper-mileing, that kind of stuff, that I feel like certainly should be part of the discussion.

So, I was interested in your sort of focusing on the high strengths deals, and not the carbon, so interested in sort of a little bit more detail on that and whether that reasonably could be sort of a next iteration or come into the study easily.

And also, so with your last few points about hydrogen taken, I guess I'm wondering, I was trying to ask it earlier, but not very eloquently, about the electric platform and how standardized is that? I mean now -- you know, given all of these great electrification technologies that are coming on, on one

or similar platforms, how smooth would the transition over to a fuel-cell based vehicle be? You know, do we have, basically, all the existing technology we need and we need to get the cost down for the fuel-cell to plunk it in that platform or kind of what's the dynamic there?

MR. SAWYER: The technology is pretty much there. And the hybrid electric vehicle has played a key role in introducing electric drive and the control of electric motors to motor vehicles.

So, it all fits together. And I think we can anticipate a time when even if we have a substantial number of internal combustion engines left that electric drive is going to be part of how they operate. That is that most vehicles will be hybrid electric vehicles.

What I didn't say much about was the other sectors in transportation. Of course, the goods movement is much more efficient than passenger cars and, therefore, the opportunities for improving efficiency are less in that sector, but the gains are great for dealing with that.

Rail, certainly in transition from heavy duty vehicles, road vehicles to rail, that's one obvious efficiency gain which can be made.

The diesel engine will probably be around for quite a while for goods movement and, therefore, making

those vehicles more efficient and those engines more efficient is certainly something which requires attention.

COMMISSIONER MC ALLISTER: Is there any plan to kind of do an update or include some of these information technology solutions and sort of look at the areas that you said you left out?

MR. SAWYER: There's another study being conducted at the present time for heavy duty vehicles, similar to the one which I participated in. And I'm not quite certain when that's going to be finished. I'm not part of it. It's another year or so.

You may know, Tom.

MR. CARLSON: I have had my head in the light duty stuff. Tim's reminding me I have to do --

MR. SAWYER: Me, too. Yeah, is there something --

COMMISSIONER MC ALLISTER: Great stuff. I really appreciate it and I'm sure Tim is plugged in to what you're doing.

MR. SAWYER: Good. And don't hesitate to contact me if I can be of use.

COMMISSIONER MC ALLISTER: Perfect. Thanks again for coming.

MS. RAITT: Thank you. Are there any other

folks in the audience who would like to have comments or questions? Okay, we have one person on WebEx, John Rozsa. Oh, sorry, you're unmuted now.

MR. ROZSA: The demand model implied that fuel prices were an input and I expected to see alternative fuel price forecasts as you did last year. And I was wondering what the status of those was?

MR. EGGERS: Good afternoon, I'm --

MR. ROZSA: Are they available? Are they available?

COMMISSIONER MC ALLISTER: We're just getting to your question. A staff member's coming up to the podium to address your question. So, thanks, just a second.

MR. EGGERS: Yes, I'm Ryan Eggers, Energy Commission Specialist in the Transportation Fuel Office.

We did present our fuel price forecasts in our June 26th workshop. To my knowledge, they are still unchanged from that particular time.

So, I would push you to go seek my presentation from the June 26th workshop.

MR. ROZSA: Okay, I'll take a look at that.

MR. EGGERS: Thank you.

MR. ROZSA: I'll take a look at that and thank you.

And, also, I might suggest a game changer. The

autonomous vehicle will bypass intrastate air and the high-speed rail. And because the only limitation, the only reason that you're limited to -- that you don't want to travel by vehicle is because of the amount of time you have to spend driving. If you don't have to drive and you can rest in your vehicle, you're not going to choose to go through security at the airport or security for high-speed rail. You'll get in your car and you'll drive to wherever you want to go.

So, this kind of bypass is a pretty likely alternative and certainly a game changer that you could expect in the near future.

COMMISSIONER MC ALLISTER: Thank you for your comment.

Do we have anybody else on the phone or on the web?

MS. RAITT: Nobody on the phone, so I think we're done.

COMMISSIONER MC ALLISTER: All right, well I think that -- does that get us through the agenda? I think it does.

MS. RAITT: Yes.

COMMISSIONER MC ALLISTER: Okay, wow.

MS. RAITT: So I just wanted to put this up to remind everybody that comments are due September 6th.

Information is provided on how to submit comments. And I think we're done.

COMMISSIONER MC ALLISTER: Good to go. Okay, well, I want to thank everybody for coming, really helpful, a lot of information today.

I'm always impressed with the Transportation Division, the Fuels and Transportation Division on how up they are.

This is such an important area. And this has not been my area, in my career, and so I always learn something here that I did not know, in this case, a lot.

And, you know, it is really about both -- as Professor Sawyer said, about technology and policy, and the details of the fuel supply, and all of those things come together in really interesting ways that it's really critical that our staff, as they do, keep tabs on it all and figure out how it all fits together going forward, very complex stuff.

So, with that I will pass the final work off to Commissioner Scott, the Lead on Transportation here.

COMMISSIONER SCOTT: All right, thank you, Commissioner McAllister.

I just kind of want to echo Commissioner McAllister's thanks to all of our terrific presenters today. We really did get a lot of great information and

we have over all of the three workshops I think that we've put together, on transportation. So I want to thank everyone for that. Thank our commenters and also the participation from our interested stakeholders. It's been -- I always do learn something new, as well, and I've been working on transportation for a little while.

And just to say great job to Heather on her first workshop and congratulations, again, on your new opportunity. So, thanks everybody.

(Thereupon, the Workshop was adjourned at 3:02 p.m.)

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