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In the Matter of:
IEPR Commissioner Workshop on ) Docket No. 17-IEPR-05
Preliminary Transportation )
Energy Demand Forecast )

Preliminary Transportation
Energy Demand Forecast

CALIFORNIA ENERGY COMMISSION
ROSENFELD HEARING ROOM - FIRST FLOOR
1516 NINTH STREET
SACRAMENTO, CALIFORNIA

TUESDAY, JUNE 20, 2017
10:00 A.M.

Reported by:
Kent Odell

California Reporting, LLC
(510) 313-0610
APPEARANCES

COMMISSIONERS

Robert Weisenmiller, Chair
Janea Scott, Commissioner

ENERGY COMMISSION STAFF

Siva Gunda, Demand Analysis Office, Energy Assessments Division
Jesse Gage, Transportation Energy Forecasting Unit
Mark Palmere, Transportation Energy Forecasting Unit
Sudhaker Konala, Transportation Energy Forecasting Unit

AIR RESOURCES BOARD

Anna Wong, Air Pollution Specialist

PUBLIC COMMENT

Brian Cope, Southern California Public Power Authority
McKinley Adee, ATRA
Lisa McGhee (via WebEx), San Diego Airport Parking Company
Matteo Muratori (via WebEx), NREL
AGENDA

Introduction
Heather Raitt, California Energy Commission 4

Opening Comments
Chair Robert Weisenmiller, California Energy Commission
Commissioner Janea Scott, California Energy Commission

Overview of Transportation Energy Demand Forecast
Siva Gunda, California Energy Commission 6

Fuel Demand Forecast
Jesse Gage, California Energy Commission 13

Vehicle Demand Forecast
Mark Palmere, California Energy Commission 22

ARB Midterm Review ZEV Regulation Compliance Scenarios
Anna Wong, California Air Resources Board 33

ZEV Analysis
Sudhakar Konala, California Energy Commission 57

Public Comments
71

Closing Remarks
80

Adjourn
83
PROCEEDINGS  

10:04 A.M.

SACRAMENTO, CALIFORNIA, TUESDAY, JUNE 20, 2017

MS. RAITT: Good morning and welcome to today’s IEPR Workshop on the Preliminary Transportation Energy Demand Forecast.

I’m Heather Raitt. I’m the Program Manager for the IEPR. I’ll quickly go over our housekeeping items.

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

Also, please beware that our workshop today is being broadcast over our WebEx conferencing system, and is being recorded. We also will have a written transcript of today’s meeting, and it will be available in about a month. And the WebEx will be available in about a week.

There will be an opportunity for public comment at the end of the day, and we’re limiting comments to three minutes per person. If you’d like to make comments, please fill out a blue
card. And you can go ahead and give it to myself or to the Public Adviser in the back of the room.

For our WebEx participants, you can also comment at the end of the day. Just raise your hand to tell our coordinator that you’d like to make a comment and we’ll open up your line at the end of the day at the appropriate time.

And materials for the meeting are available at the entrance to this hearing room, and available on our website. Written comments are welcome, and they’re due on July 5th. And the notice gives all the information for submitting comments.

And with that, I’ll turn it over to Chair Weisenmiller. Thank you.

CHAIR WEISENMILLER: Thank you.

First, I’ll note, today is a Flex Alert. So I encourage people not to be wearing their sport jackets or suit jackets today. But anyway, whatever you’re comfortable with. But it seems like it’s a good idea in this context to, yeah, notch it down a little bit.

Again, I want to thank everyone for being here today and participating in the workshop. I think one of the core Energy Commission functions
is the Demand Forecast. And certainly, more and more we’ll focus on transportation. That is 40 percent of our -- roughly 40 percent of our state’s greenhouse gas emissions. It’s also about -- it was 80 of the air quality, the air pollutants. So in terms of trying to look through and figure out how our policies are effecting the transportation sector is becoming more and more important.

So anyway, thanks.

MS. RAiTT: So our first presentation is from Siva Gunda from the California Energy Commission.

MR. GUNDA: Thank you, Heather.

Good morning, Chair Weisenmiller, Commissioner Scott. Thank you everyone for being here in person. And welcome all for those who have joined us through the webinar. So I’m Siva Gunda. I’m the Manager for the Demand Analysis Office in the Assessments Division, which is tasked with developing the Transportation Forecast.

So the Transportation Forecast Lead is Aniss Bahreinian. And she’s supported by a staff of five that work in different areas of expertise
that’s around aviation, light rail, fuel prices, the overall ZEV mandate, and so on. And the purpose of the forecast, the Transportation Forecast, is really to support the overall Demand Forecast of the Commission, so something that the DAO provides -- produces every year.

And as Chair Weisenmiller was just pointing out, the increasing electrification of vehicles is becoming an important aspect of the Transportation Forecast. And that is really helping us evolve this forecast into a more nuanced forecast that both addresses the overall Demand Forecast that is required by the DAO, but as well as give opportunities to really understand how the different policy and the regulatory mandates are really reflected in the forecast years.

So the purpose of the workshop today is really to present the preliminary results that the Transportation Forecast Team has come up with and solicit both the stakeholder feedback, as well as the guidance of the Commission leadership.

So as the Transportation Forecast continues to evolve, both from the decline of the
conventional fuels and fuel stock that we’ll see in the marketplace, as well as rapid electrification, and an increase in the alternate fuel technologies, we have a real opportunity here to take into account all the outputs that we bring forth from our forecast.

Within the forecast, we do just -- we do not just do the overall demand of the fuels, we also, as a part of that, come up with the overall stock of the vehicles, the different classes, the population, the technologies that are in the marketplace over the forecast period, the VMT of these different vehicle classes, as well as the efficiency. So this gives us a lot of opportunity to really participate in the dialogue that makes the regulatory framework, as well as the mandates, the different mandates we have, really come to bear.

So a few things I want to start about. From a schedule standpoint, we have some important dates for those of you here in the audience, as well as joining us through the webinar. We have the public comments for this particular workshop on July 5th. And then the Transportation Energy Supply Workshop is on July
6th. So that workshop really focuses on the prices that we use for our forecast, those are the inputs. And for those of you who are really interested in the price assumptions and the inputs that we use, as well, both for conventional fuels, as well as for electricity, that’s an important workshop to attend.

That’s followed by August 4th when we have the Electricity Demand Forecast. This is the overall California Energy Demand Forecast. For those of you interested in that, that’s an important date to remember.

In September on the 20th, we have the Natural Gas Outlook Workshop for those of you focused on natural gas. And we follow that with the revised Transportation Forecast at the end of November, and that is followed by a Staff report that details the overall inputs, assumptions, the modeling, as well as the Device Forecast results.

Typically in every year when we did this forecast, we kind of laid it out as inputs, assumptions and the results, because we were really focused on just putting out the numbers that the overall transportation -- the overall California Demand Forecast need for the
transportation sector. But this year, both based on guidance from the leadership, as well as other divisions who rely on that information, we tried to structure the presentation as key takeaways from what we’ve gotten from early results.

So the first one really caters to the overall Demand Forecast, so that’s something that Jesse Gage is going to talk about. But when we look at the overall Fuel Demand Forecast for California, the one lesson we really see is a declining trend for gasoline demand.

That’s followed by Mark Palmere. He’s going to cover the vehicle stock, which is one of the outputs we get in our modeling. And there’s a real increasing trend in the alternate fuel vehicle technology. So that’s an important takeaway from the early forecast results we have.

And the last thing really talks to the electrification that we talked about. So this is something that -- so Sudhakar Konala is going to cover, which will talk to the trends we see in the overall electrification of vehicles and how that compares to the ZEV mandate.

Before I kind of hand over to Jesse, I just want to have your attention on this one
slide. So the Transportation Forecast is a pretty complex model that is used. It’s actually a number of different models that the Transportation Team puts together. It’s divided into multiple subsectors. But we use a mixture of econometric, as well as behavior models, to forecast.

So as you see to the left, all the way to the left, the first box of the inputs is the economic demographic data. That is really stage one of the forecast. The first stage of the forecast is to really understand the vehicle population over the forecast period.

The next stage of the forecast is really looking at the overall forecast and then segmenting that into different classes of technologies and vehicles. So that is done through a combination of what you see towards the right end, which is the vehicle attributes, and the box which says “2016 California Vehicle Survey.”

So the vehicle attributes is basically an understanding or a forecast of how the different attributes of the vehicles are going to play out in the marketplace. That could include the price...
of the vehicles, the range of the vehicles, the acceleration of the vehicles, and the different things that people care about.

So those vehicle attributes really are an implicit understanding of the marketplace and how the marketplace responds to the different regulations that are happening. So, for example, based on the café standards or the ZEV mandate, we expect that the manufacturers make certain adjustments to the vehicles to make sure those kind of regulations are taken into account. And those regulations then will affect the attributes of what we assume the vehicles will have, moving into the future. And based on those attributes, when we mix them with the consumer preferences of what they’re looking for, we come up with what kind of fleet mixture we might have in terms of technologies in the marketplace.

So as you see all the way down, we really care about two things, or at least those are two important outputs for our model scale, one is the Transportation Energy Demand which is used by the overall California Demand Forecast, but the other one is the California vehicle population. And as I said earlier, the other key pieces are really
understanding the VMT by class and technology, as well as the deficiency.

So these various outputs that we generate through the process of the modeling really will give us an opportunity today and moving into the future to understand how the different regulations and mandates in the -- mandates are really affected the marketplace and the response in the marketplace.

So with that, I will pass it down to Jesse. Thank you.

MR. GAGE: Good morning everyone. I am Jesse Gage and I will be presenting the fuel demand portion of the Transportation Energy Demand Forecast.

A quick rundown of what I will be covering over the next nine slides. We’ll start with a discussion of the transportation demand cases we will be considering. From there, I’ll go over our fuel costs, which are obviously a core component of fuel demand. After that will come the preliminary Fuel Demand Forecast itself, including conventional fuels, alternative fuels, and wrapping up with a brief look at high-speed rail.
It is important to keep in mind that while we are today focusing on the Transportation Energy Demand Forecast, it is but one component of the overall California Energy Demand Forecast. Our demand cases need to be consistent with that more general forecast, which is why our demand cases are called what they are, a mid-electricity demand case or mid case, bracketed by high and low electricity demand cases. The definition if these cases, of course, manifest in several of our variables, specifically income and population, or even more specifically, number of households, are kept higher in the high electricity demand case compared to the mid case.

In the low electricity demand case there was a separate forecast for income. But currently, household count for now is being kept the same as the mid case.

Fuel prices also vary in the three cases, and we’ll take a look at those now.

When the previous IEPR Forecast was prepared two years ago, prices had been over $100 a barrel for just a few months prior. The 2015 to 2017 prices turned out to be lower than almost all predictions, and moreover has spent the past
two years in the $40.00 to $50.00 doldrums. This has resulted in unexpectedly low gasoline and diesel prices.

As you can see, we have three very distinct cases for crude oil price, a high price case where the cost per barrel returns to what it was in the early part of the decade, a mid case which largely follows the trajectory of the past couple of years, and a low price case where the low prices of 2015 are the new normal.

Historical data is from the Energy Information Administration, while projections are courtesy of my colleague, Ysbrand Van der Werf, who can field questions if you have any.

Before we look at cost-per-mile projections of individual fuel technologies, let’s discuss for a moment the major trends we’ve discovered in our analysis by sector. But before that, we should digress into a quick explanation of the broad classification of on-road vehicles, medium, medium-duty, et cetera.

By light-duty vehicle, this is what you likely have in your garage, a passenger car or a pickup truck. The upper limit of this is somewhere around a Ford F250 pickup truck. It’s
limited to what we consider light duty. Medium-duty covers your box trucks, such as UPS, FedEx delivery trucks, or maybe one of those food trucks you might see outside on days when it’s not 110 outside. Following that there are what we’ve termed medium-heavy duty, which may cover professional trucks, furniture delivery trucks, and the like. And then beyond that, you have the full on heavy-duty when you’re talking about long-haul semis.

So back to fuel trends. In the light-duty vehicle realm, electricity is projected to have the lowest cost per mile, while hydrogen’s cost decreases dramatically during the forecast period. Electricity is also the cheapest of the various fuel types for medium-heavy duty. For those medium-heavy duty trucks, electricity is seen as a less developed option. And any inroads there are probably in the much longer term. In its place are diesel-electric hybrids, with natural gas trucks still being a smidgen cheaper per mile than diesel.

First, please note going forward, I will be discussing strictly the mid case, as we don’t have light-duty vehicle attributes for the other
two cases. We will be covering those more in depth during the revised forecast workshop in November.

With that out of the way, we have our cost-per-mile projections for light-duty vehicles. Two things to note here.

First, not all vehicle classes are projected to accommodate all fuels. For example, there is no word of anyone planning a fuel cell full-size van. Second, this is not a fleet-wide average, but the cost of fuel per mile driven for cars of a particular model year.

The hydrogen price scenarios are proposed by NREL and reflect the reduction and the costs of the hydrogen production. Electricity, which is almost uniformly flat on a cost-per-mile basis, is prepared by the Supply Analysis Office. Gasoline and diesel are based on EIA prices, while where rising fuel costs in the mid case outweigh efficiency improvements, leading to a gradual increase in cost per mile over time.

The story for medium-duty trucks has more or less been covered in the previous slides. Electricity is flat, as it is with light-duty, while other fuels follow more or less the same
trajectory as gasoline and diesel did for light-duty.

With larger trucks on the lower end of the heavy-duty realm, we see the same story with diesel-electric, natural gas and diesel, but you can see the cost of propane taking off. This is a consequence of a projected increase of propane experts driving up the fuel price.

That wraps up the cost-per-mile comparisons.

So let’s move on to overall fuel demand, beginning with conventional fuels.

Let’s start with gasoline, as it’s still the heavy hitter and it’s the only one on this chart with some real movement here.

As gasoline has been relatively cheap and California has more or less dug out of the Great Recession, gasoline consumption has seen an uptake over the past few years. Our preliminary forecast suggests that this trend will reverse course and begin a decline, with about a 2 billion gallon reduction in annual consumption by 2030, which is a rate similar to that which the EIA has forecasted in their more recent Annual Energy Outlook.
There are a number of factors contributing to this reduction, including, in no particular order, increased fuel efficiency, rising fuel costs in the mid case, and displacement of gasoline-powered vehicles by alternative-fuel vehicles.

In contrast to gasoline, diesel remains relatively flat, as increased freight demand is balanced by increased efficiency. Jet fuel tracks closely with diesel, as it generally does in California, although it should be noted that this close tracking is more of a coincidence than anything else.

Turning now to alternative fuels and moving top to bottom, the increase in natural gas is spearheaded by a take-up in heavy-duty tractor trailers. Electricity gets a push from a number of sources, including light-duty, battery and plug-in electric vehicles, as well as electrification projects, such as Caltrans. Note that I am excluding high-speed rail from this particular slide, and we will cover it separately in the next one.

E85, while never approaching the highs of natural gas or electricity, does see a rise from
consumers opting more to fuel their flex-fuel vehicles with ethanol.

Finally, increased hydrogen refueling station availability, lower prices for producing hydrogen and the rollout of a broader range of fuel-cell vehicles lead to that market beginning its journey.

A quick note here. If you have the older version of the slides that were posted in the docket, this one has changed significantly.

The California High-Speed Rail’s 2016 Business Plan detailed two distinct stages of HSR. The system is currently slated to open with the so-called Valley-to-Valley Line in 2025, shown here in Blue, connecting San Jose to a station just north of Bakersfield. This is followed in 2029 by an extension north to San Francisco and south to Anaheim, shown here in red. This forecast was received directly from the California High-Speed Rail Authority.

That wraps up my segments. If you have any questions, we can field them.

CHAIR WEISENMILLER: Yeah. The question I have is on high-speed rail. Obviously --

MR. GAGE: Yes.
CHAIR WEISENMILLER: -- this is the high-speed rail piece. There’s other transportation efforts going on in California, and trying to see if we’ve captured those or, at least over time, we can build those in.

Obviously, one of the things that we just got was the Federal Government funding for the line from San Jose into San Francisco, switching that rail from diesel to electricity. I’m not quite sure the timing of that, but that’s started.

Los Angeles had a major ballot initiative passed last year to really continuing amping up the subway system down there. I don’t know if you’ve got the details on it, but I think it’s like $100 billion, or something just amazing, you know?

MR. GAGE: Uh-huh.

CHAIR WEISENMILLER: And at the same time, one of the aspects of the gasoline tax bill was, I think it’s a diesel line going out to Merced. That again, I think, is light rail.

So anyway, it would be good to think a little more comprehensively about some of the other transportation projects on the agenda.
MR. GAGE: We can do that, sir.

CHAIR WEISENMILLER: Thanks.

MR. GAGE: With no further questions, that wraps up my segment.

Now over to Mark Palmere for a look at the vehicle fleet.

MR. PALMERE: Thanks, Jesse.

Good morning, Commissioners, stakeholders, members of the public. And I also want to welcome Anna Wong, who is here from the Air Resources Board, who’s also presenting today. So we thank her for taking the time to come over here. She’ll be talking about ZEVs later.

So I’m Mark Palmere, Energy Analyst in the Transportation Energy Forecasting Unit. So in addition to fuel, our models also forecast vehicle stock, or more simply, the number of vehicles on the road each year. Today, I will give a brief overview of the inputs our model uses and the outputs we take away from it, as well as highlighting some key takeaways.

So in order to forecast details about vehicle stock, before we can look at fuel types or first classes, we first must answer a relatively straightforward question: How many
vehicles will be on the road each year? We calculate overall stock as a function of economic and demographic data inputs, with personal stock influenced by population and per-capita income and commercial stock influenced by gross state product, which indicates economic activity.

So this chart here shows the growth of light-duty vehicle population. You’ll remember from the last presentation, light-duty vehicles are basically vehicles under 10,000 pounds, or in more understandable terms, basically anything smaller than a UPS van. Here we see the stock forecast from the present up to 2030 in there cases, high, mid and low. Now you may notice that the mid and low cases forecast similar overall vehicle stock. This is because, although we have three cases, we use only two population forecasts, the Moody’s Household Forecast for our high case, and the Department of Finance Household Forecast for our mid an low cases. However, there’s still a value in having three cases, instead of two, which comes later when looking at fleet composition.

In addition to calculating vehicle stock, we also break down the population by fuel type
and class. Now you may recognize this flowchart from Siva’s presentation. But let’s actually take a closer look at what influences fleet composition, specifically the inputs circled here.

The forecast of future trends uses current vehicle trends in the form of -- current vehicle population breakdowns in the form of DMV data, as well as vehicle attributes and consumer preferences from the Vehicle Survey to come up with sector, class and fuel type distributions. We find, through the use of our Vehicle Survey, that attributes are a major factor in determining vehicle choice. In other words, while income and household trends predict the number of vehicles purchased, attributes and preferences determine the types of vehicles.

So the attributes here are weighted in our model by importance, as we have found that vehicle range and price are most important to the consumer, but factors such as fuel economy, acceleration, et cetera, are also considered. Once attributes are collected, including projections of future trends, the model weighs them based on importance, as determined through
consumer preferences.

So the other main input for vehicle choice, consumer preference, is determined by the results of the Energy Commission’s California Vehicle Survey. This survey has been conducted periodically since the 1990s to reflect changing preferences of consumers. The Technical Lead for the survey is our unit’s Aniss Bahreinian, who is here to answer any questions you may have about the survey.

In the survey, we ask both residential and commercial owners about their current vehicles, which current vehicles, which we call revealed preferences, as well as asking them to pick a hypothetical vehicle when given different choices, which we call the stated preferences. Using these data, we come up with parameter inputs for our model to reflect these preferences. And as previously mentioned, preferences change. And notable we found in this survey compared to the last one, which was conducted back in 2013, include in residential a higher preference for PEV incentives such as tax credits and rebates, but lower preferences for fuel economy and vehicle price. And in
commercial a continued high preference for price,
but lower preference for fuel economy.

Taken together these inputs give us the
composition of the vehicle stock on the road
throughout the forecast. As with the fuel price
slides, we’ll be focusing on the mid case where,
as you can see, gasoline is projected to remain
the predominant technology throughout the
forecast. However, a closer look at the top
quintile of this chart shows significant
alternative-fuel vehicle market penetration.
Zero -- ZEV credit earning vehicles, which are
electric-hydrogen fuel cell and plug-in hybrids
go from making up just 0.6 percent of the vehicle
population in 2015 to 6 percent in 2030, a
tenfold increase.

COMMISSIONER SCOTT: I just want to weigh
in here. I think that we -- and I’ve gotten some
really detailed and excellent briefings from the
team on the assumptions and the information that
we’ve put together.

One of the things that we still need to
do in this space is to understand studies, like
Bloomberg’s Forecast for where alternative-fuel
vehicles, like electric vehicles, can be. Think about some of the -- and I recognize that they are not regulations or anything like this -- but the policies and stated goals of, you know, the ZEV Alliance, for example, in 2050, they want to strive to have all vehicles sold be -- 100 percent of the vehicles sold be vehicles with zero tailpipe population, and just put this a little bit into the context of some of the -- what some of the other studies are showing in this space.

CHAIR WEISENMILLER: Yeah, that would be good. I guess we want to make sure we got docketed the Bloomberg, you know, the National Academy study, and some of the other studies. So I’d like to get those in the docket for this.

I think the other thing that, you know, having just spent some time in China, obviously, with the Governor and Mary Nichols, I can say that there’s a real push now. One of the things that came out of SAM (phonetic) was basically for a 30 percent target for ZEV in 2030, and that’s worldwide. And China, actually, right now has like a million -- actually, it’s hard to figure out Chinese statistics, but anyway, like a
million ZEVs at this point. But, I mean, we’re talking to some cities that are talking thousands of buses, all their patrol cars, you know, thousands of taxis in a matter of a year or two. So again, things are moving really fast there which, of course, I’d say for the Governor and Mary and I, our vision is that we really drive down cost, you know, as that goes forward. So that’s -- but I think starting to get some of that here is important.

I guess the other thing just to probe a little bit on is, obviously, we have a model which looks at flows and stocks. And so one of the questions is that how fast does the stock change over? And, you know, I think my impression was that the average life of cars in California is at least 12 years, you know, what we’re seeing now in our study. But, you know, that’s part of the inertia on the transformation. And, you know, obviously at this point the Air Board is doing a lot to -- obviously, the older cars are the dirtier cars, right -- so a lot on trying to move out the older vehicles. But as the technology changes and opens up, you still have the question of how fast does the existing
stock change over? And that’s going to be
important to understand that and policy tools
that might affect the stock.

Do you have a sense of, you know, what
the mean or average life of our fleet is at this
stage?

MR. GAGE: This is Jesse Gage again. I
have taken a look at the DMV database.

CHAIR WEISENMILLER: Uh-huh.

MR. GAGE: I take a look at that every
six months. We get a data dump of that.

CHAIR WEISENMILLER: Right.

MR. GAGE: And your intuition is correct,
it’s about a 12-year turnover for vehicles at
this point.

MR. PALMERE: And just to add, the idea
of vehicle stock turnover, we also, next -- or
the next slides are going to be about new vehicle
sales, so that sort of shows more stronger trend,
because sales are going up, but this represents
the less -- the time that it does take to turn
over, because there’s still going to be old cars
on the road for, like Jesse said, about 12 years
on average.

So, yeah, actually, yeah, those are the
next slides.

So we do see similar increases in new vehicle sales as the ZEV-earning vehicles -- ZEV credit-earning vehicles are forecast to make up almost ten percent of vehicle sales in 2030. The ZEV forecasts will actually be discussed in much greater detail in the context of complying with ARB ZEV Regulations in the next two presentations by Anna Wong and Sudhakar Konala.

But one other type -- one other fuel type I would like to expand upon now is diesel, due to its recent fluctuations. And this is just a closer look at the top portion of the vehicle sales share chart.

So we did see a major drop from 2015 to 2016 in light-duty diesel sales. However, this trend is not forecast to continue. After the VW scandal, as well as difficulty in meeting emission standards, manufacturers shifted away from diesel cars, and as a result, many such models were discontinued and diesel car sales dropped almost 90 percent in just one year to a bit over 1,000. But the main source of light-duty diesel sales continues to be pickup trucks. Sales actually rose over 30 percent in 2016. And
with light truck sales continuing to rise due to increased preferences for size, we expect them to more than compensate for any further decreases in car sales.

With these data, we can now calculate fleet-wide fuel economy. Now if you’ll remember, fuel economy was mentioned as an input earlier, but that is just fuel economy by fuel type and class. This is fuel economy among all vehicles, which uses the composition of vehicle population output to determine an overall average. In other words, the quantity of vehicles of each fuel type and class sold effects the overall fuel economy number.

We see that California has historically had an overall fuel economy higher than that of the United States as a whole, meaning its consumers purchased more fuel-efficient vehicles on average.

Here we see forecast fuel economy reaching approximately 35 to 37 mpg in California by 2030, depending on the case. And that is in line with the EIA’s nationwide forecast of 30 to 31 mpg at the same point in time, remembering that national fuel economy has historically been
a bit less.

My final slides show freight truck share by fuel -- freight truck sales share by fuel type. Bob McBride is the Lead Staff for our unit’s forecasting, and he is here to answer any specific questions.

But to summarize the key points, we see a similar penetration of alternative fuel vehicles, vehicle sales, in the medium- and heavy-duty markets. Since diesel is the main fuel for freight, freight hybrids consist of diesel and electricity and are forecast to make up about one-third of medium-duty sales in 2030, with natural gas and full electric also making inroads.

Natural gas is the main alternative to diesel in the heavier trucks, as shown in this chart of new heavy-duty truck sales. As you see, it makes major inroads on the diesel market, as well as diesel-electric hybrid. But propane makes little impact, likely due to rising propane fuel costs, which we saw in the previous slides.

Now that we have looked at fuel types in aggregate, we will now narrow our focus to zero-emission vehicles, as they are an important facet
of the policy we study. But before that, if there are any more questions about this presentation?

COMMISSIONER SCOTT: I don’t have any more questions.

CHAIR WEISENMILLER: Actually, we’re going to have public comment at the end of the day. Yeah. Thank you.

MR. PALMERE: Okay. So up next is Anna Wong from the Air Resources Board with her presentation on the ZEV Regulation compliance scenarios in the Midterm Review. Thank you.

MS. WONG: Good morning everyone. My name is Anna Wong. I’m a staff Air Pollution Specialist for the California Air Resources Board, and thank you so much for having me be able to present these compliance scenarios.

The compliance scenarios have changed, obviously, significantly since they were first sort of presented in 2012. And so I’m going to talk about the process that we went through to change them for something we called the Midterm Review. And that was a bigger process that we looked at the standards that were adopted in 2012, and we took a review of those standards
back to the Board earlier this year in March, down in Riverside. So all of those proceeding are online, and I invite you to check them out. It was a pretty exciting Board hearing, as Board hearings go. Okay.

So this should be a very familiar picture. I’ve shown it hundreds of times, I feel. But we created compliance scenarios that went along with the new rules that we adopted in 2012. And the reason why those rules were so significant at that time was that this was the first time we ever increased the ZEV mandate. This was an increased annual requirement through 2025 model year.

And the reason why we have to come out with compliance scenarios is, A, we have to model our costs whenever we do a rulemaking. And I have to show how my program, the ZEV Regulation, translates into vehicles. And that’s a problem because my program is based on credits. And those credits are given to each vehicle based on its electric range. So this is complicated be you have to assume what kind of vehicles make up that new fleet coming in. And so what the ZEV Regulation does is it requires manufacturers to
produce a certain amount of credits each year, and that is based on their annual sales. So we came up with this compliance scenario, we call it the 2012 Compliance Scenarios, but it’s actually put out in 2011. We workshoped it as early as 2010. So these are quite old as far as scenarios go. And it projected about 1.4 million ZEVs on the road by 2025 as a result of the regulation. And that’s a mix of battery-electric vehicles, fuel-cell vehicles and plug-in hybrids. That results in about 15 percent of annual sales by 2025. Now, obviously, things have changed, and they’ve changed rapidly since this program’s adoption in 2012. So I’m going to go through some of the inputs that really affect these scenarios. So we’ll start with what we had in 2012, going into these scenarios. I’ve listed a bunch of items here, and I’m not going to go into all of them because it would be very boring for all of you. And I’ve written a whole paper about you, and I invite you to read it. But the two things that really matter here are electric range and how quickly that electric range grows. And this will have a
significant impact on the number of vehicles that
come out of these compliance scenarios, again,
because each of those credits is given to a
vehicle based on its range.

And all of the vehicles that were assumed
in this scenario in 2012 were 100-mile BEVs. You
had some fuel cells mixed in there. And then you
had a lot of low-range-ish plug-in hybrids,
probably closer to the original plug-in hybrid,
Accord, that were -- that was out, like in
2013/2014 for about a model year. So we’re not
seeing those type of vehicles anymore.

So that’s just an interesting thing that
we did not necessarily predict. So there was no
growth in range, there was only going to be 100-
mile BEVs, and they were going to be for forever,
I guess. So that was, I would say, not the
wisest assumption, based on what’s now happened,
so reality has hit.

If you look at this chart, this is 2012
through 2017, and this is the number of credits
that we require, that’s what’s in that blue area,
that blue shaded area. But if I put on here the
actual credits that were earned, you can see that
manufacturers have been over-complying with the
regulation, and this typically happens all the time. The requirements kind of go up and the manufacturers are able to either over-meet those, or they’re preparing for the future. It’s hard to tell in this type of regulation.

And why did this happen? Well, we have manufacturers actually making vehicles for the first time since the history of this program. It was adopted in 1990 and you have 2011 hitting with the Bolt and with the Nissan Leaf, those are big deals within this industry, so that happened. And then we have manufacturers announcing longer-range vehicles than we could ever imagine possible within the battery-electric vehicle range, and a huge uptake of Volt-like plug-in hybrids. And when I say that, those are really strong plug-in hybrids with long electric range. So this all happened and it really through the scenarios we developed kind of into a different arena. And we needed to really look at those when we looked at the Midterm Review and say, well, now how many vehicles are we going to get from the regulation?

There’s also been this monumental support
for electrification. And I know that Commissioner Weisenmiller already talked about this, but there’s a global support for electrification; it’s not just California anymore, it’s a lot of different countries pushing for these policies. And the manufacturers are responding. We’re seeing huge announcements for 100 percent electrification by 2050 by manufacturers. So again, this is a different trend that we had to quickly kind of match our client scenarios with.

So we developed new scenarios. And what we had is we had five more years of actual compliance and actual numbers. We also -- the CVRP Team does a great job of trying to predict the amount of rebates that they are able to give out. And so they have their own way of doing projections, and we wanted to make sure that those aligned as much as they could.

But in the scenarios that we modeled, we still did expect compliance. And what I mean is you saw in that earlier slide, we have usually kind of a lower requirement, but we see actual sales higher than that. So this is just saying
if everything failed, what would the regulation require us to do at the end of the day? How would it be a backstop? So that’s what the 2018 through 2025 numbers, all these numbers, that’s what they represent is kind of the minimum number that we could say would be on the road if all else failed, if there was no rebates, if there was no nothing.

I have on here, “Section 177 States,” I’m not going to talk about them today, but they are the states that have adopted California’s regulations. And the tool that we developed also looks at those numbers. So if you are very interested in those ten other states, the numbers are on that calculator.

We used the information that we gathered during the Midterm Review. We met with almost every manufacturer. We talked about confidential information. We did not use any of that confidential information in these scenarios, but we did just go through some thought exercises of how they might comply, knowing the industry trends that we were seeing with those meetings.

We also used a growth rate with that range, which was a different approach than we did
before. You saw that zero percent growth rate. There was never going to be a better car than a 100-mile BEV. But we are seeing that as the exact opposite of what is happening, so we allowed for a growth rate to be in there that can be played with, and we played with that in these three scenarios.

And then we also, just as a side note, we have -- we still have, obviously, fuel-cell vehicles within these scenarios. And though the AB 8 Survey results are confidential, we have confirmed that they are at least within -- in line with what we're seeing through those survey results and what have been publicly reported in aggregate.

This is just an explanation of the tool that we used. We call it ZEV calculator. It’s posted up on this link online. I’m guessing that these presentations will be posted or have already been posted. But this is a little bit, I hope, friendlier version of the calculator, that if you would be interested, you could run your own scenarios. You can run three scenarios at a time. And we developed this to be a much more public-friendly, or at least stakeholder-holder
friendly, calculator to run these scenarios.

Along with this goes one of the attachments of our Midterm Review Report, which was quite lengthy, but Attachment A or Appendix A is our analysis of these things. And it will go into far much more detail than I’m going to go into today about every single assumption that we made going into these scenarios. Okay.

So one different approach that we did, and I explain a little bit more about this, we chose technology themes, instead of a lowest case to midrange case and a high case. And the reason why we did that is we’re not into rulemaking. Rulemakings, you typically say how few vehicles are going to come out of this, how many could possibly come out of this, and you have to do kind of costs between those two and come up with a middle. This, we decided to take advantage of. Well, what about -- what do we see -- how do we see manufacturers comply when faced with different technology situations? So let me just read through these and hopefully they can make sense to everybody.

So in our midrange case, we kind of assume that there’s continued advancement in ZEV
technology, like we are seeing now. And what that does is it allows some manufacturers, they do really, really well and they continue on building what they say that they’re going to build. And they use the -- how do I describe this? They use the flexibilities in the regulation moderately. So when a manufacturer doesn’t have a product, they tend to use their regulation credits significantly. They’re buying from other manufacturers. They’re diversifying their portfolio of credits. And they’re spending those credits because they don’t really have a the yet, or they’re waiting for that technology to come out, or they’re just one model year away, or whatever is happening. But they will use the regulation credits to sort of get through the day.

Then there’s the people that have -- the manufacturers that have wild success so far in the regulation. And they have so many credits and they’re not so dependent on the regulation. They just sort of comply. They want us to ignore them and they do their own thing. And in this midrange case, we sort of assumed that. We didn’t assume huge gaming of the regulation, huge
use of the flexibilities, but that it would be moderate case.

In this next case, in the slow ZEV technology case, we decided, well, what about if there was some big delay in advancement? All of sudden, you know, you had a big PR nightmare around battery-electric vehicles, or something that really stopped things or had to really put things on hold, or maybe those 200-mile BEVs that were promised, or something terrible would happen. And so in that case, we kind of assumed everybody would rush to get as many credits as they could. They would use heavily the flexibilities allowed in the regulation. And they would not be making such -- the vehicles that they promised. They would be kind of going back to the bare minimum, making just the bare minimum.

And then in the high ZEV technology case is, well, in 2012 we assumed 100-mile BEVs, and now we’re seeing 250-mile BEVs on the road five years later. Well, what about if that happens again? What about if we have 400-mile BEVs by, you know, two years from now? So this is a very aggressive case in which technology range is
going very quickly. It’s building up. The manufacturers are very excited about this technology and they just go all in. And this case, again, we have very highly capable ZEVs and plug-in hybrids on the road, and that is the way that they comply. They are not really concerned with the regulatory mechanism that they’re allowed. They just want to get the technology out there because that’s what the public wants, and they’re responding.

So that’s the three different themes that we did for these three cases. And I’m going to present mostly on the midrange case because it’s just one of the cases that I can talk about the most easily.

You can see, the cumulative results, and this is not -- we did not try to get such tightly grouped results, but results in over a million vehicles cumulatively from each of these scenarios. That does include about 350,000 vehicles prior to 2018 model year that are on the road that either we’re seeing now or have -- or were projected for 2017 model year. We don’t have all the data for ‘16 and ‘17 model year yet. But I’m going to talk about the midrange case.
So again, this is continued advancement of the ZEV technology. And it’s a balance of new sales of improved ZEV capability, but there’s also moderate use of the flexibilities that are allowed. So you can see that on averages or label ranges, BEVs go from 150 miles label range to about 210 miles by model-year 2025. And you might say, well, I thought all BEVs were going to be 200 miles. Well, they might not be. We might still see 150-, 100-mile BEVs. We’re not really sure what’s going to happen there. And it will be -- we think it will probably be a mix.

And then these are sort of regulatory terms, but non US06 and US06 plug-in hybrids. Non US06 plug-in hybrid is something like a Fusion, it’s a blended plug-in hybrid in which something like an acceleration of a freeway onramp, there might be some engine assistance in order to get you up there, so it’s not a pure electric for a certain amount of time, though they do have that capability in range -- low speed situations. And then US06 plug-in hybrids are plug-in hybrids that deplete the battery and then the engine will come on, so like a Volt-like plug-in hybrid. So I just wanted to describe the
differences there. But we see both of them playing a big role in all of these compliance scenarios. Okay.

So these are the annual sales. You can see, those are the bars in the back. And we’ve stacked the technologies on top of one another. And then, again, we’ve just put that cumulative line on the chart, just for reference. This does not include the 350,000 vehicles prior to 2018 model year.

So we get to about this -- I didn’t put it on here, but it’s about seven-and-a-half, eight percent of new vehicle sales by 2025, again, just as a result of the regulation, not of an actual forecast or anything that we’re saying the actual market will do. It was just the backstop.

This is a little bit more into the weeds, but this is how the numbers change specifically. If you’re really interested, we did use a different annual sales, and we had to use AEO annual sales, that’s a U.S. sales number, and we used a California share of those sales. And we did that because we needed to do California sales, and we needed to do Section 177 State
sales, so I had to start with a U.S. number so that we could have comparative results from those numbers.

Then when you add in the regulatory flexibilities that were approved by the Board in 2012, and the updated technology assumptions, and then for the first time we also used banked credits that the manufacturers had already earned or that we were assuming them to earn prior to 2018. So you can see how we get from that 2012 eyesore number, sorry, Initial Statement of Reasons number, the staff report number, down to the 2018 -- or 2017 midrange case that I’ve added on there, the 2010 through 2015 population, as well as the ‘16 through ‘17 estimate that we did for the Midterm Review.

This is sort of a summary of all of these things. You can compare all the different assumptions that were made in each of the cases. But this -- if you’d like to really study the numbers, you can look at all these things across the board. But again, the most significant chance and the really -- the one thing that really had an effect on the numbers was the overall label range going up for all vehicles.
And so that really will bring the overall number down, because the more each vehicle earns, the less vehicles you can expect from the regulation. And that’s all I have. Do you have any questions?

CHAIR WEISENMILLER: Yeah, actually, a couple.

Commissioner Scott had mentioned earlier some of the outside studies, the National Academy or, you know, Bloomberg. I’m just trying to figure out how much you looked at those studies in what you’re doing and what you found, the value in those, so which was best, which was worst type of thing.

MS. WONG: Often we use those types of studies. Because they’re forecasts, we have to look at them in terms of did they consider the regulation when they looked at these scenarios? So we just want to compare the actual numbers. We also want to look at their range assumptions, obviously. And we often use them often for costs, just how are they costing out, batteries and things like that?

So -- and I’m not sure which NAS study that you’re talking about, but like the Barrier
Study (phonetic), we found very interesting. And it came out right in the middle of this Midterm Review. And it confirmed a lot of our story around what the purpose of the regulation was versus the purpose of the broader market.

And so there are these barriers. And, you know, whether or not the regulation can solve all of them, you know, I think that we’ve seen that it can’t solve every problem, but that we need a lot of different things acting at the same time in order to get over some of those barriers.

So things like CVRP or infrastructure are incredibly important, if not just as important as things like, you know, the stick of the regulation in the background.

So I think that we see -- we do appreciate those studies and the work that comes out of them. And often we use them to kind of confirm what we were thinking or what we’ve been hearing from the manufacturers in order to develop these scenarios.

CHAIR WEISENMILLER: Well, I think in the recent Bloomberg Study, they point a lot to the research they’ve done on batteries to try to understand what’s going on there in terms of cost
and range and how that really ties back to the ZEV side -- or BEV side of stuff. And again, just trying to see how much that fit into your thinking.

MS. WONG: Yeah. I think often it’s helpful in confirming what we’re hearing from the manufacturers. It’s good to always have more data points than just them. And especially third-party research is really, really helpful.

CHAIR WEISENMILLER: I’m going to ask you a couple questions about other ARB programs, and there may be things you can’t comment on or outside of your -- which is fine.

So, obviously, one of the other backdrops is land use planning, I guess SB 375, you know, in terms of looking at the pieces in the Transportation Forecast. One of the pieces is how much do people drive? And I know the Air Board has been trying to deal with some of the land use planning issues. Is there anything you can -- how are we taking that into account while thinking about our forecast here?

MS. WONG: Well, I think that -- I know that Aniss has been meeting with a lot of those folks over at our -- at the Air Board and has
been working with them on how they develop --
ythey develop other types of tools, more bigger
picture, looking at how do you meet 2050 and
beyond goals. So I know that they’ve been
considering that. I’m not directly involved, so
I would not be a good authority. But I know that
those. I’ve been a part of those meetings.

CHAIR WEISENMILLER: Okay. The other --
the similar question is that given, from an air
quality perspective, the older cars, A, the cars
are a big deal, and B, older cars a key part of
that. And so what’s the Air Board doing to
basically encourage the turnover in the fleet
faster?

MS. WONG: There’s a program called EFMP,
the Enhanced Fleet Modernization Program. And
then there’s a PlusUp (phonetic) program which
encourages lower -- it’s focused on lower-income
populations, giving, I don’t know if you want to
call them rebates, but bonuses to retire their
vehicles and then get into either at least hybrid
or something that is a little bit newer than
their vehicle. And I know that they’ve been
working with the different Air Districts to
implement those programs. It’s been active for
at least the past, I don’t know, ten years or so to do that. And I know that in the last two or three years this focus on ZEVs has been incredibly influential in getting people into used ZEVs that are coming off the market, off these leases.

CHAIR WEISENMILLER: Right.

MS. WONG: Yeah.

CHAIR WEISENMILLER: Well, one of -- looking at the forecast, we have a continual amount of diesel, you know, in the truck side. And we also have, you know, looking at the heavy-duty, et cetera, there’s been some transformation but not a lot, particularly when you think about the L.A. Basin compliance.

So you want to talk for a minute about the sustainable freight strategy and how that might affect things? Or is, again, that outside of your --

MS. WONG: Definitely outside of my --

CHAIR WEISENMILLER: Okay. That’s fair.

MS. WONG: -- comfort zone.

CHAIR WEISENMILLER: That’s fair.

Thanks. Thanks. Again, as we go forward, I’d certainly want to encourage the staff to look at
is 375, the sort of rebate, or whatever system, on the older vehicles. And then also the sustainable freight strategy on how that might effect that piece of transportation.

Thanks.

Excuse me. Do you have anything?

COMMISSIONER SCOTT: Well, I do.

I just want to say thank you so much for being here. We really appreciate your partnership as we’re putting this together. I think it’s important in this space that the state is speaking with one voice, and that our assumptions are reflective of what you see happening with compliance with the ZEV mandate.

So I really appreciate you walking us through this.

And one of the reasons I wanted to have this discussion now is because for those of us who kind of do this all day, every day, I think we are aware that with the range changes and some of the things that you highlighted in your program -- in your presentation, that the number of vehicles is a little bit -- is less than when we were talking about this before. But we wanted to make sure people really understood that and
where that was coming from. So I very much appreciate your presentation.

One thing I wanted to check on, and it may not be a question for you, it may be a question for me and you and the team offline a little bit, but it in your midrange case on slide ten, I think you mentioned that that would be about seven-and-a-half to eight percent of vehicle sales by 2025 due to the regulation. And then you described to us prior to that what that midrange looked at. And I think that in our slide we had, I think, five percent maybe of ZEVs in the 2030 time frame. So we need to do a little chewing up, I think, of that in understanding the difference.

CHAIR WEISENMILLER: Yeah. And I would note, the Scoping Plan has between 4 and 5 million in 2030, I think it’s 4.3 million, which is at the same time when we did the update pathway. So if anything, I would argue it should be higher.

COMMISSIONER SCOTT: Okay.

CHAIR WEISENMILLER: But the Air Board hasn’t pushed it beyond that, so it’s probably a reasonable assumption.
COMMISSIONER SCOTT: Well, we’ll do so more work on there.

MR. PALMERE: Oh, sorry, if I could just -- this is Mark Palmere.

So our -- the six percent number was overall vehicle stock. So the new vehicle sales by 2025, they are over five percent of ZEVs.

CHAIR WEISENMILLER: Okay. Good.

MR. PALMERE: So, yeah, just if -- yeah, just looking at the similar numbers, yeah.

CHAIR WEISENMILLER: Yeah. No. That’s good.

Also, the other question for you is just the split between a plug-in versus battery. My impression was that as the ZEV sales have grown the plug-ins have been relatively constant and the ZEV is sort of picking up some of that.

MS. WONG: So that was the truth through 2016 model year. But, actually, this year, we’ve seen an increase in plug-in hybrids.

CHAIR WEISENMILLER: Okay.

MS. WONG: And that’s probably with the release -- the re-release of the plug-in Prius Prime and the new Volt.
CHAIR WEISENMILLER: Yeah.

MS. WONG: And other things were happening where a lot of BEVs were kind of delayed. But we’re seeing -- we almost -- the plug-in hybrid number right now is almost equivalent to what it was in 2016 right now. So it’s been about 50-50 with the BEVs slightly above, only because there’s just so many models of BEVs compared to plug-in hybrids. So it seems to always kind of be evening out to about 50-50, but we’ll see. It’s always an interesting question. These 200-mile BEVs have truly changed the game for all of us in the best way possible --

CHAIR WEISENMILLER: Well --

MS. WONG: -- in the best way possible.

CHAIR WEISENMILLER: -- and the other game changer is certainly China -- with China’s insistence on BEVs, you know, that Toyota is getting back into BEVs because they have to sell in China, and that’s the world’s biggest car market.

MS. WONG: Uh-huh.

CHAIR WEISENMILLER: So, you know, and that’s something which is sort of an amazing
shift for them --

MS. WONG: Uh-huh.

CHAIR WEISENMILLER: -- to go from plug-in only to, yeah, oh, now it’s time to do BEVs --

MS. WONG: Uh-huh.

CHAIR WEISENMILLER: -- and fuel cells.

MS. WONG: Yes.

COMMISSIONER SCOTT: Thank you.

MS. RAITT: Thank you, Anna.

So next is Sudhakar Konala from the

Energy Commission.

MR. KONALA: Hello everyone,

Commissioners. My name is Sudhakar Konala. I’ll be doing a brief analysis of ZEV Forecast today.

And during any of the slides, if you have any questions, please feel free to ask me because it is a little bit technical.

So in this section I will be covering a couple of items, including vehicle attributes that are important in driving ZEV sales,
specifically I’ll be talking about BEV range and price. I’ll also summarize how many vehicles we estimate will be on the road through our forecast period. And I’ll describe how we verified that our forecast projects compliance with
California’s ZEV Regulation.

So the first slide I have here is about the range of battery-electric vehicles, and we forecast it to grow over time. So this slide shows average BEV range for different vehicle classes as we classify them, as the Energy Commission classifies them. And although range is forecasted to grow, there are two specific trends that I’d like to point out.

First is through 2020 the growth in BEV range is pretty fast. This reflects projections that we made based on announcements of new models made by manufacturers, as well as those reported by the media. And it represents a push by manufacturers to introduce vehicles with 200-mile range in the near term.

Beyond 2020, range is projected to grow, but at a slower rate. And essentially the assumptions that went into that is a more conservative approach to improvements in battery technology, and the assumption that manufacturers would shift more towards lowering vehicle costs, rather than expanding range rate while keeping vehicles more expensive.

So I have seven classes listed here and
the average range for each class. These are the specific inputs that are actually fed into the model. And the model then determines -- incorporates preferences for battery-electric vehicles based on these range values, and we get the output values that I will be talking about in later slides.

One point I would like to make is the large swings in range, especially in the early years. These large swings, either up or down, are due to introduction of new models. So if you look at the light blue line, you can see that the average range for compact cars is going up from below 100 miles in 2016 to almost 200 miles in 2017. This change reflects sales of the Chevy Bolt, which we classify as a compact car. You can see similar trends happening for midsize cars and small crossovers. So these reflect anticipated new model introductions, and the likelihood that these new vehicles will be well-selling vehicles.

If you do not have any more questions, I will move on to the next slide. Okay.

So the second slide, it’s the same information as a previous slide, but stated in a
different way. The previous slide, they were actually the inputs that are fed into the model. Once we run the model, we get a projection of sales. I took those projections of sales and I created a sales-weighted average of all battery-electric vehicles sold for each model year. So this is one number, and easily understood number that represents the average range of all battery-electric vehicles in that model year. So the solid green line reflects this value for all battery-electric. And you can see that in 2016, we project a value of about 150 miles, and it goes well beyond 200 miles by 2025, and it continues growing thereafter.

Also, because premium battery-electric vehicles make up a large portion of BEV sales today, I also made a rough calculation of what the average range of non-premium BEVs would be. And by non-premium, I’m essentially talking about all vehicles that are not Tesla’s high-end vehicles. And you can see that there is an even higher growth in average range for non-premium BEVs, from below 100 miles in 2016 to also above 200 by 2025.

One point I would like to point out is on
this chart I also placed assumptions about range made by the ARB in their Midterm Review. So this range shows the highest possible range in their high-tech scenario and their lowest assumptions on range in the low-tech scenario. The solid blue line represents their mid-technology assumptions on range. And you can see that both our overall BEV and non-premium BEV range all fall within the range that the ARB anticipated in their Midterm Review. And we actually -- our mid case slightly exceeds ARB’s mid case, even through 2025.

Now moving on from range, I would like to talk about battery-electric vehicle prices. And the general trend here is we see battery-electric vehicle prices declining over time. But there are two sub trends that I’d like to point out that we expect to see in the market.

The first is through 2020, as manufacturers introduce better and longer range vehicles, we actually expect the battery-electric vehicle prices to rise. This is the nature of the game. If you want to introduce better vehicles, they’re going to cost more to bring them to market, and this is what we anticipate.
But after a certain point, range becomes less of a factor. And we anticipate that manufacturers are going to concentrate more on lowering cost than expanding range at all costs.

So at this point, starting in 2020, we see the costs of battery-electric vehicles declining significantly over time, so that most of them are even lower than current prices. These declines in the cost of battery-electric vehicles squarely are correlated with the costs in -- sorry, decrease in costs of battery packs.

And the prices of battery packs that I used for this, I got directly from what manufacturers have shared publicly through investor presentations and annual reports. So I looked at numbers published by automakers, like GM, Ford and Tesla, and I averaged those numbers to get an average number for the fleet, and I used those numbers to decrease the cost of better electric vehicles.

There was a study done by UBS Research, just about a month or two ago, where they looked at the battery cost of the Bolt. And they came up with a figure of $31,500 for what they expect a Bolt to cost in 2025. I used the same methodology I used for our battery prices here,
and our value for the Bolt came out to be within a couple hundred dollars of what UBS stated. So I’m fairly confident that these numbers reflect what manufacturers choose to follow. Okay.

Moving on from prices and range, I just would like to make -- to talk more about how many vehicles we expect to be on the road. So on this chart we highlight how many vehicles we expect in all of our scenarios, both the low, the mid and the high. The low and the high just represent the shaded blue region, and the mid is a solid blue line. In this case, we expect about 715,000 vehicles by 2020, approximately 1.4 million by 2025, and over 2 million vehicles by 2030.

One thing I would like to highlight is that all three of our scenarios are above the values that ARB projects as needed through 2025 in all three scenarios.

I would like to caution, though, that while I am presenting on road population, this is not a measure of compliance. I will talk about compliance in a couple of slides thereafter. But having an idea of how many vehicles on the road is helpful for all stakeholders.

Next, I would like to talk briefly about
our forecast for fuel-cell electric vehicles.

So by 2025, we anticipate that there will be between 175,000 and 240,000 vehicles on the road, with our mid case being about a 190,000 vehicles. We compared our values with those presented by ARB in the 2016 ARB AB 8 report. And our projections are slightly above those from the AB 8 report.

So these fuel-cell vehicle numbers are a subcomponent of the total ZEVs that were presented in the previous slide. This slide also has battery-electric vehicles and plug-in hybrids, as was noted earlier.

Finally, after our forecast outputs total ZEV sales and stock on the road, the CEC’s Transportation Demand Forecast assesses market demand for ZEVs and generates a forecast of sales. By converting this forecast of ZEV sales to ZEV credits, Staff can check the forecast results for compliance with ARB’s ZEV Regulations.

So what we did was we took ARB’s ZEV calculator and modified it so that our -- the output from our models could be input into the calculator. And we just run the calculator to
see if our forecasts were compliant in terms of credits. And what we found was that the forecast projects compliance in all three of our cases.

Now in the low case, compliance is close. In the mid case, in the high case, there is a good -- there is a reserve of banked credits that's maintained throughout. So this is something that we will further monitor as we go forward.

Finally, talking about -- one final topic I would like to talk about is how electric vehicle owners’ preferences are in terms of charging.

This chart that you see here is a graphical depiction of the results obtained from the 2016 California Vehicle Survey about residential BEV owners. This chart has implications for grid operators, and it also presents an area for further exploration of study for the Energy Commission moving forward.

Here the chart has data collected from BEV owners. And we see that nearly 70 percent of residential BEV owners, as reported by the survey, plan to charge their vehicles at home and overnight. Now this does not come as surprisingly
news to anyone. Most people would expect that charging occurs at night and at home. But there are several interesting trends that we’d like to point out.

During the day most of the charging occurs at work and at public charging stations. And although this value is lower, we find that these stated preferences will be useful for grid operators as they continue to plan electricity demand going forward.

So this concludes my part of the presentation. If you have any questions, I would be happy to take them. Otherwise, I will turn the presentation back to Siva Gunda.

CHAIR WEISENMILLER: Okay. Just a couple.

MR. KONALA: Yeah.

CHAIR WEISENMILLER: I noticed in your fuel-cell presentation --

MR. KONALA: Yes.

CHAIR WEISENMILLER: -- yeah, I mean, it may be that being trained as a nuclear chemist, I tend to think of things in exponential growth. But, I mean, that’s certainly the typical metaphor for new technology. And this certainly
is not an exponential scale, but is more of a conventional scale.

So part of it, I suggest that on the technology side, I know we’ve done some stuff, more in the Demand Office, on PV growth, rooftop, solar, which again is using models that reflect more of that diffusion of technology, which is somewhat, well, obviously more exponential in the early years, and then flattening over time, which is probably what you would anticipate here. The other thing to -- so in terms of long-term thinking, it would be good to bring in some of that technology adaptation-types of diffusion models.

The other thing is, like I said, the scoping plan does have -- 4.3, I believe, is the 2030 number. So it would be good to look at the work papers for the scoping plan and try to understand, you know, what -- some of the differences. You sort of seem to be hitting things at 2025 consistently with the Air Board, but sort of not quite consistent in 2030.

MR. KONALA: Uh-huh. We will look into that.

CHAIR WEISENMILLER: Okay.
You?

COMMISSIONER SCOTT: I don’t have any additional questions on this one.

CHAIR WEISENMILLER: All right.

MR. KONALA: With that, I turn back to Siva Gunda for his concluding remarks.

CHAIR WEISENMILLER: Thanks.

MR. KONALA: Thank you.

MR. GUNDA: Again, I’d just like to close off our segments with just highlighting some next steps for us.

So based on some of the inputs we are going to gather from both stakeholders and the comments that we received from the Commissioners, we’re going to incorporate a lot of those feedback into our revisions for the revised forecast.

So important things to consider there is that as of today we do not have the vehicle attributes, for example, for the medium-duty vehicles, which we are still working with NREL. Those attributes are going to come later this summer, which are going to be incorporated into our revised forecast, as well.

Apart from that, we are also trying to
consider the time of use electricity for our forecast, so that’s something that we haven’t done in the past. But we are looking into how to adopt the time of use into our forecasts.

And finally, we’ll be generating our revised forecast in the September time period and it will be ready for sharing that publicly in November.

And we really appreciate all your comments and feedback, which will help this get better.

So I also want to just close off with some thank you.

Anna, thank you so much for being here. Thank you, also, for going through (indiscernible) to kind of see and explore all the opportunities of collaboration.

I also want to thank the FTD, the Fuels Division. I’m still here -- I’m still new here. This is my first (indiscernible) and it’s kind of a little nerve-wracking for me. But so we got a lot of help from FTD in terms of helping us with helping us getting the vehicle attributes through contracts with NREL.

Thank you to SAO (phonetic) for helping
us with the vehicle prices.

A special thanks to Charles Smith, who’s here, who’s helping us with the IEPR chapter.
And Matt for really working with us in revising the presentation, as well as the content and the way we presented this in this public forum.

So you’re inputs are really welcome. So thank you again. And I just want to show all the names of people who actually do the work. I’m just standing up here. So thank you.

CHAIR WEISENMILLER: No, thank you.
I think we’re now at that stage for public comments or questions, I think.

MS. RAITT: Yeah.
CHAIR WEISENMILLER: We’ll start with folks in the room.

I don’t know, Public Adviser, have you gotten any blue cards? I know we have at least one gentleman who has a comment or a question, but have you gotten any blue cards?

Why don’t you come up and identify yourself.

But anyone else who has a comment or question, if you could fill out a blue card, that would be good.
And as you start, you’re going to need to identify yourself for the court reporter.

MR. COPE: Thank you Chairman. Brian Cope with Southern California Public Power Authority. I’m sorry I didn’t fill out a blue card. I will before I leave.

When I started to sit, I was going to ask a question of Mark real quick. But in reality, the question or the answer isn’t really important. I was kind of curious about the sample size of the survey that was done of the residential and commercial customers, and where it was.

But in summary, I guess I would go to support you and Commissioner Scott in your consideration of the other outside factors, besides just what Californians want. There’s so much more to be considered, that I encourage Staff to add that to your considerations going forward. But I commend all of you here, Staff, for putting this together.

Thank you very much.

CHAIR WEISENMILLER: Well, I think the other area you might help us on is, as you know, there’s a real science in designing polling
questions like this. And the question of, you
know, how well these are set up, you know, I
haven’t dug into that. But I certainly encourage
people to look at that and make sure the
questions, in fact, aren’t bias in a way that
lead in different directions.

MR. COPE: I agree.

CHAIR WEISENMILLER: You know, obviously
the people who -- ask the first Chair of the
Energy Commission, Richard Mullen, that’s his
job, designing polling. And Richard is very
sensitive to the way the questions are framed?
Anyone else in the room, questions or
comments?

Please. You know, again, come on up.

Yeah. Identify yourself. The court reporters
going to need that.

MS. ADEE: Sorry for not filling out a
blue card. McKinley Adee with ATRA.

Commissioners, I commend the staff for
the initial work that they’ve done on this
Transportation Energy Demand Forecast. Just a
couple of questions on a couple of slides, number
ten from the Energy Commission’s presentation.

They don’t have to answer it now, but I just want
to sort of highlight some of this.

The cost-per-mile calculation for electric vehicles seems to be quite optimistic. That’s light-duty vehicles. I would make the same observation for medium-duty vehicles on slide 11. And the reason for that is we’ve been part of a team that is doing some work for some of the utilities that are looking at SB 350-type demonstration projects. And we’ve spent some time taking some of the transportation electrification charging rates and converting them to cost-per-mile information. And we’re seeing some different numbers.

One other observation on slide 16, the idea that BEV prices are doing to be declining over time, kind of wondering whether the staff considered the manufacturer cost losses that are reflected in some of the current vehicle pricing? So, for example, we know that GM and Nissan lose about $8,000 to $10,000 per Bolt or Leaf that’s sold today. It will be of interest to know how the staff considered that kind of a loss in their future price projects.

I think I will end there.

CHAIR WEISENMILLER: Well, certainly, if
you could provide for the record any studies you’ve done on rate structure impacts on charging, that would be very interesting.

MS. ADEE: Yeah. That feeds very much into some of the adoption rates and again, as I mentioned, the cost-per-mile performance.

CHAIR WEISENMILLER: Well, in the --

MS. ADEE: Yeah.

CHAIR WEISENMILLER: -- Financial Times in the last month, their article on greening, you know, they have a chart that shows, in terms of gigafactories, and god knows how you define a gigafactory, but one in the U.S., one in Europe, and nine in China. So --

MS. ADEE: Yeah.

CHAIR WEISENMILLER: -- you know, the bottom line is the Chinese are really moving into batteries fast, and plan to really reduce cost fast. I think quality is another question, but we’ll see.

MS. ADEE: Thank you.

CHAIR WEISENMILLER: Thanks.

Anyone else in the room?

Please come back up, Brian.

MR. COPE: Brian Cope with SCPPA again.
I would suggest that the staff might want to look at a recent study that just came out from the Haas Institute in Berkeley about, basically, its pricing and elasticity of demand based on time-of-use rates. There’s been quite a -- they did quite a study on really how people respond to time-of-use rates. And it’s almost scary that they’re really -- it’s a very inelastic market. They’re -- people are not moving as much demand off-peak as you would expect. So you might want to factor that into your consideration in the --

CHAIR WEISENMILLER: Yeah.

MR. COPE: -- for the Haas Institute.

CHAIR WEISENMILLER: Yeah. It’s probably more generally for the Demand Forecast, although, certainly there’s applicability here.

Anyone else? Anyone on the line?

MS. RAITT: Yes. Waiting to get the name real quick here.

And while we’re waiting, I’ll just add that the presentations are posted on the website, but we’ll be updating the Energy Commission staff presentation for the latest version later today.

Okay.

There is one question. “What percent of
the vehicle sales will be electricity by 2030 in California," and then it says, “by five percent?” I’m not sure what that means.

MR. PALMERE:  Sorry. Mark Palmere.

Is this battery-electric only? Is that the --

CHAIR WEISENMILLER:  For simplicity, why don’t you give both. You know, just go to the chart and point to the, if you can, the battery and fuel-cell.

MR. PALMERE: So this is, yeah, this is a look at the top 20 -- the top of the graph. So we have electric. Electric is about five percent, hydrogen, one percent, and plug-in hybrid, about two percent, and this is in the mid case. And if the questioner would like, we can get the more precise numbers, the actual numbers. This is just the chart. But we do have the precise numbers available.

MS. RAJT: Thank you.

It looks like maybe we have one more. We can’t open the line? Okay.

So we’re waiting to see if we can open the line for the person to be able to ask their question.
MS. MCGHEE: Hello?

MS. RAITT: Yes. Go ahead.

MS. MCGHEE: Oh, okay. Good. This is Lisa from San Diego Airport Parking Company. And I did have a comment, just looking at vehicles and not only the cost per mile, but also the availability of vehicles.

Have you looked at what is the growth in terms of different vehicles that are available? Because it seems like when we look at electric vehicles, there seems to be a lot of higher end. When I look at the -- when I look at the Clean Vehicle Rebate Program or I look at the list of vehicles, I’m seeing ten Teslas and nine from the other makers. And it seems to be pretty much a duplicate from 2016 to 2017.

So I’m just trying to understand where some of this information is coming from in terms of what’s going to be a future, input from other OEMs participating in other types of models of vehicles, besides just mostly the compact. Because at the mid review there was a couple of comments that were brought forth that we’re not seeing any accelerated participation with OEMs in the trucks and the bigger vehicles. And also
that goes and applies for the medium-duty
vehicles, as well. It’s very fragmented right
now. And I would like to hear some comments on
that, as well.

MR. KONALA: This is Sudhakar Konala.
And I did look at the trends for light-
duty vehicles. And for 2016, for example, I saw
that Tesla made up about over 40 percent of BEV
sales. So, yeah, we do factor in historical
trends in terms of electric vehicles to see what
kind of vehicles are selling.

MS. MCGHEE: And so have you noticed that
there is a lack of participation when it comes to
the SUV and the truck? And when we go into -- 50
percent of all commercial vehicles are the
Sprinter van, which is about an 8,500 to 10,000
gross vehicle weight vehicle. And you’ve only
got one electric vehicle in the entire country.

Have you guys had any forecast as to how
we’re going to help accelerate some of these
other midsize, larger vehicles that are really
kind of in bets light-duty and heavy-duty, but
ey are -- some are part of light duty and some
are specifically medium-duty. But we really
aren’t seeing any progress in that area.
MR. KONALA: I can speak about light-duty vehicles. But for answers on heavy-duty, I’d have to defer to our lead on the freight, which is Bob McBride. I don’t know if he wants --

COMMISSIONER SCOTT: Well, Sudhakar, let me jump in here.

So this is really a question, not about forecasting and how we’ve pulled together the numbers, but about -- I would put that more in our AB 8 Alternative and Renewable Fuel and Vehicle Technology Program where we are working to incentivize vehicles of all types. And that’s something that we ought to think about with respect to that program, in that we are thinking about how do we put some incentives in the space to really get some more models or bring the cost down and things like that? So I’d put it more in that category than into the number of vehicles that you’re using in your forecast.

MS. MCGHEE: Okay. Thank you.

COMMISSIONER SCOTT: Uh-huh.

CHAIR WEISENMILLER: Anyone else?

MS. RAITT: We have one more question that we’re getting ready for.

CHAIR WEISENMILLER: Good.
MS. RAITT: Matteo, I think your line is open if you want to have your comment?

MR. MURATORI: Hello. This is Matteo Muratori from NREL.

I was wondering if, when projecting the cost per mile for the diesel vehicle types, you’re including the actual cost, like the cost for building -- having it a fueling station or the EV chargers for electric vehicles?

MR. GAGE: This is Jesse Gage.

No. Infrastructure costs are not included in this. This is strictly looking at fuel efficiency versus fuel costs.

MR. MURATORI: Thank you for clarifying.

MS. RAITT: That’s all the questions from WebEx.

CHAIR WEISENMILLER: Great. Well, I want to thank -- I wanted to, again, thank everyone for their participation today. This is certainly an important topic. I appreciate Staff’s work on focusing on it and sort of working in a corroborative fashion with the ARB, as certainly this is -- you know, this whole area of ZEV is very important to California, you know? And I think trying to figure out what the appropriate
forecast is and how we can change the forecast to make it more aggressive is sort of what we’re -- change it in terms of policies, obviously, is what I’m trying to say, to actually achieve higher numbers, is where it’s going to be a very important function.

It’s also important that basically everyone has a chance to participate in programs. So along with our obvious focus on this sort of new purchase, and then trying to figure it out in terms of how to move from the city-used vehicles more out into the general fleet, so that all Californians can participate, will be important.

So again, thanks for being here. And I want to remind everyone, your comments, we’re looking forward to those. I’m sure Heather will remind people of the date shortly.

MS. RAITT: July 5th.

COMMISSIONER SCOTT: Sure. And I would just echo the Chair’s appreciation for the work that has gone into putting this together. We really appreciate it.

I’ll underscore a couple of the things that we wanted to be sure to look at, and that was the scoping plan.
As we’re looking in the 2030 time frame, we want to try to bring to bear, I think, the Bloomberg Study or ICCT Study, or other preeminent studies that are out there that kind of are talking about where they see the zero-emission vehicle, at least, market going, and seeing how we’ve got -- where those data points are compared to where our data points are, just for reference. I think those are things that a lot of people in this field follow and would be interested in seeing. We talked a little bit about NREL and making sure we get numbers from there.

And then, you know, I would make a call, I’m not sure how many people we have on the WebEx with us and here in the room, but for us to do some reaching out to the vehicle manufacturers, to other utilities, to the industrial gas providers, and some of the folks who can also help ground truth this.

And, Mark, you talked about this, and Sudhakar, as you look through what you see on the Board presentations and different things that the auto manufacturers and others have made note of, it would be great if we could get some of them to
weigh in and take a look at our specific
information and weigh in on this, as well. So
that’s the other component that I would add.
But I appreciate very much the good work
that’s gone into this so far.
And that’s all I have. Thank you.
CHAIR WEISENMILLER: So do you want to
just repeat it?
MS. RAITT: Yes. Comments are due July
5th. And all the information is in the notice
for how to do it.
CHAIR WEISENMILLER: Thank you. So this
meeting is adjourned.
(The workshop concluded at 11:38 a.m.)
REPORTER’S CERTIFICATE

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

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IN WITNESS WHEREOF, I have hereunto set my hand this 2nd day of August, 2017.

[Signature]

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

MARSHA L. NELSON, CERT**367

August 2, 2017