STATE OF CALIFORNIA – THE RESOURCES AGENCY
BEFORE THE
CALIFORNIA ENERGY COMMISSION (CEC)

In the matter of,	Docket No. 13-IEP-1L
2013 Integrated Energy Policy Report (2013 IEPR)	

Joint IEPR-Transportation Lead Commissioner Workshop
Transportation Energy Scenarios

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

Wednesday, July 31, 2013

9:04 A.M.

Reported by:

Kent Odell

APPEARANCES

Commissioners

Andrew McAllister, IEPR Lead Commissioner

Hazel Miranda, Commissioner McAllister's Advisor

Janea Scott, Transportation Lead Commissioner

Jim Bartridge, Commissioner Scott's Advisor

Staff

Suzanne Korosec, IEPR Lead

Tim Olson

Lynette Green

Also Present (* Via WebEx)

Presenters

Philip Sheehy, ICF

Allen Schaeffer, Diesel Technology Forum

Mary Solecki, Environmental Entrepreneurs

*Plinio Nastari, Datagro Brazil

Russell Teall, California Biodiesel Alliance

Joe Gershen, California Biodiesel Alliance

Tom Koehler, Pacific Ethanol

Adam Walter, Propel Fuels

*Joel Velasco, UNICA Sugar Cane Industry Association of Brazil

*David Greene, Oakridge National Laboratory

Eileen Tutt, California Electric Transportation Coalition

Catherine Dunwoody, California Fuel Cell Partnership

APPEARANCES (CONT.)

<u>Presenters (Cont.)</u>

Mark McLoughlin, California High-Speed Rail Authority

Rosa Dominguez-Faus, UC Davis Institute of Transportation Studies and Graduate School of Management

Tim Carmichael, California Natural Gas Vehicle Coalition

Johannes Escudero, The Coalition for Renewable Natural Gas

Fred Silver, CALSTART

<u>Public Comment</u>

Robert Bienenfeld, American Honda Motor Company

Simon Muoi, Natural Resources Defense Council

*Roger Gault

INDEX

INDEX(CONT.)

INDEX(CONT.)

P R O C E E D I N G S

JULY 31, 2013 9:04 A.M.

MS. KOROSEC: All right, we're going to go ahead and get started.

I'm Suzanne Korosec. I manage the Energy Commission's Integrated Energy Policy Report Unit.

Welcome to today's Joint IEPR and Transportation Workshop on Transportation Energy Scenarios.

A couple of housekeeping items before we get started. Restrooms are in the atrium out the double doors and to your left.

Please be aware that the glass exit doors near the restrooms are for staff, only, and will trigger an alarm if you try to exit 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 of the building on the table, out with the other handouts.

If there's an emergency and we need to evacuate the building, please follow the staff out of the building to the park that's diagonal across the street, and wait there until we're told that it's safe to return.

Today's workshop is being broadcast through our

WebEx conferencing systems and parties do need to be aware that you are being recorded.

I will make an audio recording available on our website in a couple of days and we'll post a written transcript about three weeks after the workshop.

We have a very full agenda today, with a lot of material to cover so we're limiting questions during the Q&E, after each block of presentations, to those from the dais.

But we will provide an opportunity for questions during our public comment periods, one before lunch and one at the end of the day.

If we can't get to your question due to time constraints, you can send questions directly to Tim Olson, whose contact information is in the notice that's out on the table with the handouts, and he will forward that on to presenters to get you a response.

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

When it's your turn to speak, please come up to the center podium and use the microphone so that the WebEx participants can hear you, and so that we make sure we capture your comments on the transcript.

It’s also helpful if you can give our court reporter your business card either before or after you speak, so that we make sure that your name and affiliation are spelled correctly in the transcript.

To give everyone a chance to speak we’re limiting each speaker to three minutes, and we’ll have a countdown clock on the main screen to help you gauge your time.

I encourage you to be brief and just hit the high points of what you have to say, and then follow up with more detailed written comments after the workshop.

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. And we’ll either relay your question or open your line at 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 August 9th, and the workshop notice explains the process for submitting written comments to the IEPR docket.

So with that I’ll turn it over to Tim Olson to provide a brief introduction before we have opening comments from the Commissioners.

MR. OLSON: Good morning Commissioners, and the others who are here today, the participants for this workshop.

We scheduled this workshop to gather information for consideration in the transportation section of the 2013 Integrated Energy Policy Report.

And you can see from the agenda that we're talking about transportation energy scenarios, primarily alternative fuels, but there are going to be some other topics raised in here, too.

And our main objective is to get better information about the contributions that several fuel options offer today and projected into the future.

Many of the speakers that have agreed to speak today are emphasizing between now and 2020. Some are looking beyond 2020, and they're today beyond 2020.

We asked speakers to comment on a few items. And the way we looked at this, it was a very simple request. And what you're going to find today is there are lots of complex responses to that simple request.

But in essence what we've asked is what contribution will you make to California's transportation energy sector at least to 2020?

And you'll find, also, that the way the agenda's kind of structured many responded in terms of fuel produced, trying to quantify the amount of fuel that will be produced year by year through that, or at least some point, 2020 at the earliest.

Associated with that is -- with the fuel production is the number of vehicles and the infrastructure needed to support that. And you'll hear from some presenters that they're just focusing on infrastructure, or they're really trying to address all three of those parts of the kind of projection.

We also asked the speakers to comment on the factors, key factors that substantiate that growth. And you'll see that the responses, most of them emphasize some kind of price comparison.

Fuel, their fuel or their electricity in one -- electricity and natural gas, or some type of liquid fuel compared to petroleum price. You'll see that in some of the presentations.

You'll also see other factors that will be addressed; consumer response, technology advances, business models, investment appetite, and then a whole realm of government interventions in the form of regulations, incentives, permitting process, and that we also asked the speakers to describe challenges that impede the ability to meet these growth goals.

We also asked, invited speakers, and for the most part any participate today to make recommendations on government actions.

This is the type of information that we're interested in that will go into this transportation chapter and, hopefully, we'll get -- I'm sure we're going to get some very good comments and recommendations.

We're also interested in using the information today to sum up where we are in addressing mandates and government policies, legislation, including the targets for petroleum displacement coming out of the 2003 AB 2076 report, revisited in 2007 in the AB 1007, that Alternative Fuels Plan.

Greenhouse gas emission reductions under AB 32, low carbon fuel standards, zero emission vehicle Executive Order and ZEV mandate, the use of our incentive money and, hopefully, we'll be able to get some comments on the SB 375 kind of regional land use planning, how it affects vehicle miles traveled reduction.

An aspect that's related to this information today will come in through another part of the report, at a future date, and that's the -- I referred back to the use of incentive money.

There's also a benefits report that's a companion to that. Jim McKinney and the staff of the Emerging Fuels Office are working on that and that will go into this 2013 Integrated Energy Policy Report, too.

So with that, that's kind of the objective for today. And we're looking forward to -- we've got a pretty intense schedule of speakers, and Power Point presentations. And so let's continue on and launch into it.

COMMISSIONER MC ALLISTER: I'll take your hint here and be very brief here, Tim.

So, my name is Andrew McAllister, I'm the Lead Commissioner on the Integrated Energy Policy Report for 2013.

And we have in front of us another of what is shaping up to be a really interesting and rich day of presentations and discussion, in particular today on transportation issues.

To my left is Commissioner Janea Scott, and to her left is her advisor, Jim Bartridge. So, I'm really happy to share the day with Janea.

And, actually, I will have to be stepping out in the afternoon, so she'll be on her own this afternoon, but ably will steer the ship, I'm certain.

And I'm actually really sad to miss the -- like, particularly, the first panel in the afternoon, Electrification and Hydrogen panel, because I think that's going to be a really interesting one and a really rich area for discussion. So, I'll be tracking that one ex post.

Let's see, I guess I just want to I mean state somewhat the obvious, but just give a few -- make a few points here. That transportation is so critical, it's huge, and ever huger in our context in terms of its percentage of the impact that it makes as we clean up the electric grid, for example, or as we make our buildings more efficient. Those go down as a percentage of the total greenhouse gas emissions.

And transportation, I think, is a particularly tough nut to crack in terms of the emissions and all the different things that are wrapped up with it.

We're lucky in that there are lots of -- there are a number of terrific technologies here, today, on the horizon. A lot of smart people are looking at this and a lot of really great potentials for getting emissions down on the technology side.

But there are many, many social systems around transportation, as well, and those prove to be remarkably difficult to modify over time.

Certainly, the plug for SB 375 I think is really apt because the regional governments, I know, are really working hard to figure out how to engineer, and fund, and shift around their transportation planning to decrease the impacts and still allow people to get around in their regions.

And they're, obviously, a local government made up of local governments and are very -- under a lot of pressure to be accountable to their constituencies at the local level.

And we need to tap into that as we develop State policy, that's critical.

Also, you know, there are a lot of different technologies. Each of them has a market and these markets are interrelated. And, you know, we have some funds at the State level to kind of push and prod in different directions that we want things to go.

But the vast majority of the capital is going to come from the markets and, you know, basically kind of responding to policy, but making decisions as markets tend to do.

So, I think it's really critical to understand those issues in some depth to work with the providers and understand the services so that we can make the right policies that don't get cross-wise with those.

And just, finally, I'll highlight behavior.

It’s just critical. And in the energy-efficiency realm, certainly behavior is a rich -- not new area, but I think it’s a burgeoning area of research because we’ve realized that widgets, while they can save us a lot of energy, they actually have to be adopted. And people make choices to purchase them, and install them, and they have to run properly.

And there’s lots of behavior, there’s lots of human interface with all of these technologies.

And that goes doubly, I would say, for transportation, and the technologies, and how people get around and lead their daily lives.

So, I just think this arena is so, so critical. Now, obviously, I’m not the Lead Commissioner on it and that distinction belongs to Commissioner Scott.

So, clearly, I think there’s a lot of heavy lifting on her plate. You know, I have enough on my plate, frankly, but I really think that all of these pieces have to fit together seamlessly.

And I’m looking forward to learning more this morning and following up later on the workshop.

Now, with that I’ll pass it to Commissioner Scott.

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

As you know, I am the Lead on the transportation issues here at the Commission and in particular for the Alternative and Renewable Fuel, and Vehicle Technology Program.

And as I look around the room and see a lot of familiar faces, I'm guessing most of you have heard of that program.

So, as part of the IEPR the Energy Commission conducts these types of assessments and forecasts for all aspects of energy industry; supply, production, transportation, delivery and distribution, demand, and prices.

And we use these assessments and forecasts to help provide an analytic foundation for developing the State's energy policies.

The transportation energy demand forecasts increase our understanding of changes in current and expected fuel consumption, and how consumers and businesses respond to the changing market conditions, advances in technologies, and government policy initiatives.

Tim Olson, in his introduction, laid out for you kind of what we're hoping to learn today, and all of the different folks that we are expecting to hear from, so I won't repeat that.

But I do think it's going to be a very informative, interesting, thought-provoking set of presentations that we will have here.

So I'll just again say thank you so much for joining us today. We've got folks from as far away as D.C., and Brazil, and we've got people WebExing in. So, we should have a really great chance to hear from a lot of experts and I'm looking forward to today's discussions.

MR. OLSON: Okay, let's proceed. We're going to start with a presentation that I think is kind of an overarching, covers lots of different options. And the author, one of the authors is Philip Sheehy. He's going to make that presentation.

And I think it's important because this will give us kind of an understanding of how multiple things will contribute.

And Philip Sheehy's with ICF. This study was done on behalf of several clients. Many of the people in this room helped pay for that.

And I'd like to introduce Philip Sheehy.

MR. SHEEHY: Thank you, Tim. Great, thanks Tim, Commissioners and CEC staff. Can everybody hear me okay on this? I just want to make sure. All right.

Yeah, thanks for having me today. Tim actually didn't ask me about my personal contribution to California's transportation energy in the future. I ride my bike to work. I live in San Francisco. So, my contribution is pretty minimal.

When I do drive a car, I'm a City Car Share member. They've got a lot of electric vehicles in their fleet, so I've got a pretty small footprint. But I did drive up here to Sacramento for today, so that increases it somewhat.

So, Tim did ask me to give an overview of some work that ICF has done for a variety of stakeholders. And I want to set the context here of this, the scope of our work is related to the discussion we're having here today, related to transportation energy forecast.

But there's a slight different in what we were asked to do. So, here's an overview. I'll give you an introduction to our work, some of the scenarios we developed.

And then the last piece, the market snapshots answers one of the questions that Tim asked about what are the justifications for some of the forecasts that you guys have.

So, just to give you an idea of the scope, so we were retained by a multi-stakeholder group, including the California Electric Transportation Coalition, Natural Gas Vehicle Coalition -- I missed a word in there, sorry, Tim -- E2 Series, National Biodiesel Board, and then the Advanced Biofuels Association.

And we were looking at compliance with the LCFS. So this study ended, it looks at between now and 2020. And it's a macro-level study, so it's an appropriate overview here.

But we weren't -- we're looking at, again, compliance with LCFS, which is slightly different than asking the question what is the transportation energy outlook?

I think there's a very subtle difference there, but they are real.

And I'm going to be talking about the first part of that study today, the reference case and LCFS compliance scenarios, and then we're doing some economic modeling on that.

The first phase of this report is public. Everything I'm presenting today is based on a report that's available publicly. I'm not going to delve into some of the -- I'm going to delve into some of the numbers specifically, but I'm not going to delve into every single number because A, I don't have time and, B the numbers are out there, available.

And if you have any comments, my contact information is at the end so I'd be happy to address those.

I'm just going to go through this so that I have enough time on the other one. So this, I like to use this slide. I've been testing things out in various forms. I got a good reception yesterday. I hope it's received well here today.

So, this slide to me, at least, sets the framework for our analysis. I think it helps people understand what we're looking for.

So, the Y axis you have carbon intensity. The low carbon fuel standard requires a 10 percent reduction in the carbon intensity of transportation fuels by 2020.

On the X axis you have time, between 2011 and 2020, the time frame of that analysis.

Where these fuels land on this graph is a reflection of their carbon intensity, between zero and 100. You can think of gasoline and diesel around 100. The two lines at the top are the standard.

And then where they fall on the graph in terms of their horizontal position determines where they play a role, what we consider a significant role, which is a relatively subjective term, in LCFS compliance.

So, you can see -- but this graph is useful to set up, you know, how we look at LCFS compliance because the lower you are on the graph -- the lower on the graph you are, the lower carbon intensity kind puts downward pressure on how much volume you need to be able to get into that market to have an impact.

The higher you are on that graph, looking at biodiesel from soybeans, or ethanol made from corn in the Midwest, those are up around, you know, 80 to 90 grams per megajoule. You need higher volumes, right, to get that 10 percent reduction.

But if you're biodiesel from corn oil, or biomethane, you're further down, you need fewer volume.

So, this is kind of the push/pull that we're looking at when we're looking at compliance with the low carbon fuel standard.

If you're in the middle, somewhere in the middle, you know, you've got hydrogen. You've got renewable diesel, around 30, that's still pretty low. Even like a blend of biomethane and conventional compressed natural gas, that blend would put you somewhere around 50.

So, you know, these things are what we consider when we're looking at compliance with the low carbon fuel standard, and availability of these fuels out to

2020.

If I don't mention your fuel today, I know there are a lot of fuel producers and representatives from various industries today, please take no offense. It has nothing to do with -- it's just the scope of our study, what we're looking at.

I'm not going to mention too many very specific pathways, so please don't take offense. That's a good qualifier to add.

So, I'd like to -- again, I just want to hammer this home that some notes on the scope of our analysis. You know, we're looking at 2020, so I didn't want to get into the details of what the low carbon fuel standard, how it's implemented. But there's basically credits and deficits and they must balance out to zero.

We hit a zero balance in 2020, right. So, that's a slightly different exercise than forecasting, saying in principle there could be, you know, over compliance in 2020.

What we're trying to do -- we think in general, however, that the market will achieve pretty close to balance in 2020 depending on how LCFS is going to be implemented post-2020, which isn't something that was included in our analysis.

So, that's a caveat and something to consider as we talk about some of these transportation fuels.

One other note, and this comes out of a discussion I had yesterday, we did not assume any shifts in the carbon intensity of the crude slate that comes into California. That changes the outlook. If the carbon intensity of the crude slate that is refined in California or fuels that are delivered to California, then that increases the need for credits, which increases the need for alternative fuels.

We did not consider that. We assumed that it is effectively frozen in 2013, which puts it around -- the carbon intensity of gasoline and diesel around that 98 grams per megajoule. I think that’s another good disclaimer there.

All right, data sources, we talked to some folks at CEC, we talked to ARB. We have contracts with -- well, we have relationships with DOE and NREL. The Department of Energy, EIA, we used some of their forecasting.

We looked at biofuels, we’re looking at USDA. We also have quite a bit of looking at a lot of imports into California, so that requires us looking beyond the United States’ boundaries, so we’re looking OECD and the Foreign Agricultural Service from USDA, we need some numbers for there.

And then we had our multi-stakeholder group that funded the study. We had an opportunity to discuss what their internal projections were.

And I think it's important to mention that, so a lot of these projections are informed by our discussions with our multi-stakeholder group, but ICF is ultimately responsible for these projects, and we were the filter.

So, what you see is not necessarily consistent with what you will hear later from some of the stakeholder groups because, ultimately, ICF modified those based on our own internal research.

All right, high level observations, we're looking at a future in which biofuel blending is the easiest, or one of the best ways towards compliance just because it's -- the other ways that we're looking at, natural gas, hydrogen, electricity, those are fuels that require a new vehicle.

And fleet turnover, as people in this room understand, is difficult to achieve, so there's a delay there. And those fuels also require the purchase of a new vehicle. They require, generally, some new infrastructure, an expansion of infrastructure.

So just to be clear, none of these scenarios are necessarily easy. That's the compliance with LCFS, we're not claiming that it's easy or going to be a cakewalk, but we're looking at the feasibility of the deployment of low carbon, liquid biofuels that can be used to blend, along with what we consider advanced vehicle technologies, which is kind of a catchall term for anything that requires, like I said, these new vehicles, infrastructure, et cetera.

I've got a couple scenarios. I'll talk about some of the differences there.

But generally one of them, the scenario one has slightly higher penetrations of advanced vehicle technologies, like natural gas and electricity, and a little bit of extra hydrogen.

And that puts some downward pressure on liquid biofuels. However, biofuels are still, aggregated together which includes a variety of biofuels, both alcohol-based and then hydrocarbon-based biofuels are still, grouped together, the largest contributor towards compliance.

Again, this is another relevant aspect. Because, again, we're looking at achieving that net zero balance in 2020. We're looking at over compliance in some of these early years of LCFS in order to achieve compliance.

So, we're looking at -- we think that is a strong motivator for some of the near-term deployment of alternative fuels because there's an opportunity to over comply in early years and bank those credits. We've already seen that behavior in the market. At the end of 2012 there was in excess of 1.4 million credits.

That doesn't necessarily speak to the liquidity of that market, but there are an excess of credits generated. Whether or not those start to be traded is another issue.

Our analysis, again at a high level we're looking at good opportunities to substitute for diesel, looking at natural gas, biodiesel and renewable diesel. There is no such thing in the LCFS as a gasoline credit or a diesel credit. So, the credits are fungible. There's not anything, necessarily, that says you have to hit the 10 percent target in gasoline pool or in diesel pool. So, we think that there's an opportunity in the diesel sector.

And this is something that's relatively new compared -- or I think it's becoming more accepted, but it's something that wasn't necessarily out there.

And there are some other studies that I would argue ignored this aspect.

So, in general I'm just -- so we're going to focus on some nascent developments, but these are things that we found promising and which reflect most of our projections here.

I think everybody has my presentation, a hardcopy of it. If you don’t, it’s online. So, in the interest of time I’m going to skip these two slides.

But just generally I’ll talk about this, some of the things we looked at. Basically, what these slides are communicating is that we capped various things based on market constraints. We’ve made assumptions in other ones.

So, you can walk through these in your own time and if you have any questions about these scenarios, I’d be happy to answer them. I’ll talk about some of them as we go through some of the individual slides. Again, just in the interest of time I’ll keep moving there.

So, what I’m going to do here, next I just want to walk through some of these, fuel-by-fuel. Again, I’m not going to mention everybody’s fuel in this room so please don’t take offense. These are -- I was charged with giving the first presentation of the day which means I have to -- I’m trying to keep it pretty general.

You could also blame my colleague, Jeff Rosenfeld if I miss something, instead of me. That’s useful, too.

So, a lot of this is, again some of these are our observations, but some of it is just out there based on reports that UC Davis has done, an update on Air Resources Board -- on the LCSF Program. I don't think any of this is groundbreaking. Some of it is new, I think.

We found that conventional ethanol producers are lowering their carbon intensity. Based on the number of pathways that have been submitted you can see there's downward pressure on the carbon intensity.

This doesn't necessarily change the outlook for ethanol. It just changes the carbon intensity outlook for ethanol.

In effect, we don't have much increase in the volumetric consumption of ethanol in California. We have some increases in some of the scenarios because we did consider E15. I'll get to that in a second.

But by and large the ethanol market isn't changing that much in our scenarios. It's really just changing in terms of what the carbon intensity is.

And I highlighted here California ethanol is -- ethanol that's produced in California is, you know, currently a score of around 80 grams per megajoule. They're seeking to maintain competitiveness in this market.

You know, based on our interviews, they're keen on dropping that to 70 grams per megajoule. And again, that's feedstock changes, feedstock switching, and then some process improvements.

Pacific Ethanol went offline recently to improve, like I think they ended up -- I don't know what they've officially released, what their efficiency improvements are, but the news releases were like I think they were expecting a 3 to 4 percent improvement which, when credits are trading at $60 a ton, you might as well go get that 3 percent.

We looked a Brazilian sugarcane ethanol. This is a hot topic. I've got a colon and a semicolon in there, that's pretty clever.

So, sugarcane ethanol is a very popular one that people like to talk about. We had about 9 million gallons imported by Marine last year. Most people believe that that was -- the main driver there was RFS2. That's ICF's view, also.

We do think that there is some pull from LCFS, though, and we think that there's a lot -- so, some projections from 2010 and 2011 had Brazil -- I think there's a woman from Brazil presenting today, but there's a -- or from a Brazilian company.

I mean at the high level there were export estimates of Brazilian sugarcane ethanol around 300 to 400 million gallons out to 2016. And, you know, we imported 500 million gallons in the states last year.

So, there is a motivation here. It’s a cost-effective solution towards compliance with both RFS2 and LCFS. You know, we can have a separate conversation about the policy impacts of fuel swap.

But the reality is that sugarcane ethanol based on its carbon intensity score and how it’s ranked in the RFS2 program we see a future for that.

And, you know, we capped this around 500 million gallons import by 2020 in California, but we did consider it.

Cellulosic ethanol, we had a couple hundred -- we worked with E2 on this. This one I think we end up with close to 500 million gallons by 2020 that’s accessible to the California market.

Again, that’s probably middle of the road. Some people would believe that is nonsense, but some people would think that might be low. So, we kind of found the middle ground there.

It’s certainly been a market in which there have been setbacks. We recognize that.

There are some success stories, which I think is good to communicate. KIOR, in Mississippi, is up and running, I think at the end of June.

Edeniq, I think they are in Visalia, California.

Don't quote me on that. And they're reporting their performance based on hours, not gallons yet. So, you know, it's nascent, again nascent.

And then ZeaChem I think is in the order of thousands, hundreds of thousands of gallons.

So, again, these aren't to say that these aren't making major contributions to LCFS now, but we're starting to see a little bit more movement than we were a year ago.

And E15, I'll -- I think we've got the volumes for ethanol right. If you want to discuss with us whether or not it was E15 or E85, we'd be willing to engage in that discussion, but we'll skip that for now.

For biodiesel we see -- again, I mentioned earlier that we saw a lot of room for biodiesel. You know, we were using on the order of 10 million, 15 million gallons of biodiesel a year in California before some of these regulations -- or before LCFS kicked in. We've seen that, you know, we think this year's going to be much higher than that.

I like to use this chart here. It's just a table of the feed sack consumption for biodiesel production in the United States. You see not a lot of movement in canola oil and soybean oil, those both have pretty high carbon intensities in the look-up tables.

But you see a big change in corn oil, almost a hundred percent increase in the production of biodiesel from corn oil, which has that four grams per mega joule.

And then you see a pretty big increase, about a 30, 40 percent increase from recycled feeds. And those are the ones that have a low carbon intensity and that we think will end up in California.

So, we have biodiesel. You know, biodiesel is less than a percent right now of the diesel mix. And in our scenarios we end up around 15 percent by 2020.

So, biodiesel on the infrastructure side, I'd like to talk about this instead of just production. So, we interacted with CEC on a variety of projects on this and there were some CEC reports. I think it might have been from the last Transportation Energy Forecast, but I'm not sure. It might have been from an AB118 report.

But, you know, as recently as 2010 they were effectively saying there's no -- or there's very little biodiesel terminal storage.

So now, just publicly, you know, Kinder Morgan is -- they've got a couple facilities that are looking at 19 to 20 million gallons per year at each facility.

We had communications with members of our -- of folks on the multi-stakeholder group who funded this study, there were four refiners there.

ICF did a survey of more than 95 -- or about -- I think it was 96, so why say more than 95. About 95 petroleum terminals in California, and we didn't get responses from everyone. But for those that we did, we make these estimates of about 230,000 barrels of biodiesel storage capacity in California today. I believe that's a conservative estimate.

If you assume that those tanks have 75 turns per year, again, I believe that's a conservative estimate, then you're already looking at a biodiesel blending capacity of 110 million gallons annually, which is a pretty big change from just a couple years ago. So, this is one of the things that we looked at.

To reach a level of B15, B10, B15 in our scenarios you're looking at like about another couple hundred million gallons there.

So, we've added, I would say conservatively, 110 million gallons capacity of blending biodiesel now. A doubling of that would get us pretty close to the scenarios that ICF developed for our compliance situation.

Drop-in biofuels, renewable gasoline and renewable diesel, you know, some people refer to these advanced hydrocarbons. These effectively have the same chemical composition of gasoline and diesel, and are fungible. There are still considerations, you can't just -- they're not always just dropped in, regardless, based on pipeline constraints.

But I'm going to spend a little bit less time on these and I hope these people aren't offended.

So, we do see a shift towards, a little bit towards renewable gasoline.

I talked to Mary, you'll hear more from Mary Solecki recently -- or this afternoon, excuse me. Or maybe this morning, I don't know when you're talking, Mary.

But there's been some shift from cellulosic ethanol production, these kind of waste products that people believed would go into the ethanol market to now there's been a little bit more shift towards renewable hydrocarbon production. And I'm going to leave that to Mary to discuss that a little bit more.

We didn't have very much renewable gasoline in our scenarios, to be honest. We're looking at around 100 million gallons accessible to the California market by 2020. It might have even been less.

So, renewable diesel -- also, sorry, just real quick, some pause from us on the renewable gasoline. We see a lot of price projections and I'm sure somebody will talk about that later today.

A lot of these price projects are -- the feedstock costs, for whatever reason it ends up being about $50 per dry ton of whatever the feedstock is. So, I don't think that -- if you back calculate it, almost everybody's hovering around this $50 per dry ton and ICF hasn't been able to find a really reliable source for that $50 per dry ton of feedstock. So, that gives us some pause in terms of what renewable gasoline is going to look like.

Renewable diesel, you know, this one is coming on like gangbusters. Neste Oil invested a couple hundred million dollars during the global economic downturn to build a facility in Singapore. I think they might have expanded their facility in the Netherlands.

It's not necessarily a punch for Neste Oil, but they were investing a lot of money when other people weren't and I think that's paid off today.

We've heard as much as 100 million gallons of renewable diesel being delivered to the California market. The driver is the tax credit, but it's still here.

A good portion of that is from tallow and that's a low carbon pathway.

There's this facility in Louisiana that just came online about a month ago.

So, we again, we're looking at around -- I think we maxed out around 150 million gallons of renewable diesel in the California market by 2020. So, you know, in the tens of millions of gallons over the next couple of years, of the low carbon sort. So, some of this 100 million gallons is palm oil, I believe, so not all of it is included in our scenarios.

So, one thing for us on the biodiesel side of what will happen when the tax credit goes away, if it goes away what will happen.

So, not to say that -- I'm not trying to make the argument that the biodiesel market will collapse by any means, we really think that biodiesel is going to be an important player in California. It's just how much of that renewable diesel will be coming here. That dollar per gallon tax credit is a big draw for places like -- or folks like Neste.

So, what will the import markets look like when that tax credit goes away? So, there's some uncertainty there. And I don't want to overstate that uncertainty, but it is real.

So, natural gas, I think everybody knows this, natural gas is cheap. Tim will tell you how cheap later.

The initial folks here, you know, transit agencies, I would say that's a success story of folks like the California Energy Commission, CARB, local air pollution districts have been pushing natural gas into transit agencies since 2000, you know. So, you're looking at already a base of 85 million gallons, you know, which is a half to two-thirds of the market.

And those folks are already earning credits and so that kind of -- there's probably some expansion from there.

So, you know, everybody or most people, I think, are familiar with Cummins Westport. They have a handful of natural gas, heavy duty vehicle offerings -- or engine offerings, excuse me, not the full vehicle.

But there are some surprising developments here, I think that communicate some of the -- or that demonstrate some of the -- why we're a little bullish on natural gas in some of these scenarios is you're starting to creep down into some of these light, heavy duty, medium duty markets, which there's a lot of miles driven in those and there's a lot of carbon reductions.

Again, we're looking at LCFS compliance. But there's a lot of carbon reductions to be had there and there's a lot of savings to be had there.

So, you know, we're talking about OEM developments here. GM is looking at the Silverado;

you've got Chrysler with the RAM 2500. These vehicles, there aren't a ton of them on the road, but there's enough out there and they drive a lot of miles, that's an important note.

And then you've got a conversion kit for the F Series. We think that's pretty big. The F Series is one of the top ten selling trucks. There aren't a ton of trucks in California that are sold, but the F Series is in the top ten, so that's a big driver there.

You know, this is -- I talk more about the medium duty, kind of short haul market. When we're starting to talk about goods movement and longer haul we're looking at LNG.

Here, you know, people are expanding. The Topock -- I was talking to my colleague, Jeff Rosenfeld, Topock facility got financing in September of 2012 to expand their facility right across the border.

I believe, we're pretty sure the Boron facility, that Clean Energy operates in Southern California expanded recently.

There are -- you know, their natural gas, getting into the LNG sector is happening. I believe it's Clean Energy is partnered with Pilot, Flying J, I think, is to build the natural gas highway across America.

So, there's a private investment in LNG. And we don't have it coming in like gangbusters, but it actually surpasses CNG consumption by 2020 just based on it getting into the heavy duty market.

And then biogas, yesterday I gave a similar presentation and just said biogas, biogas, biogas, so I thought I should probably expand on that a little bit.

There's a lot of potential for biogas. Biogas is generating RINs and it's generating LCFS credits. There is a very strong driver for any molecule of renewable natural gas to make its way to California.

There is a significant pole here. And we have biogas amounting to about 10 percent of natural gas consumption in 2020 which some people would argue is conservative.

There's already, you know, based on our back calculations, around 5 million gallons that have -- 5 million diesel gallon equivalents in the California market, so there's room for that to expand quite significantly. As the LNG market and as the CNG market expands you're going to have the vehicles, and you're going to have the infrastructure.

And biogas there's going to be a lot of -- we've already have seen a lot of investment in getting that into the transportation sector.

Electricity, we focused on light duty. So, in our analysis our baseline is ZEV. So, there's a most likely compliance scenario that ARB has developed and that's publicly available. We used that as the baseline.

We built on that in one of the scenarios and had more aggressive penetration of electric vehicles with the focus on plug-in hybrids. Some bump in fuel cell vehicles and some bump in battery electrics, but the major bump was in plug-in hybrids.

The main reason there partly is because of we think that could be a major compliance strategy with CAFE and tailpipe standards.

So, again, I think that similar to the argument related to ethanol consumption, E15 versus E85, we think the amount of electricity that we have in our scenarios is likely appropriate. Whether or not it's happening in a BEV or PHEV is a factor.

So, you have -- you may have some detractors about EV sales. Some of them are -- some people say the sales are underwhelming. However, in California I would argue they're actually doing quite well. They are surpassing some expectations and especially in -- I live in San Francisco, our market is about almost 15 percent of the electric vehicles in the nation are in San

Francisco, or in the Bay Area, I should say.

So, those are already -- you know, I think electricity is accounting for 1 to 2 percent of LCFS credits right now. That's pretty big.

So, we think that -- so there are a couple of other things we're seeing here. You know, there's economies of scale from decreasing battery prices. These things people promote regularly.

But the other thing is there was a major built out of battery capacity and we think there's going to be a bit of a run on it here and that will decrease the price of batteries, people trying to move them.

So, we think that, again, there's been a short-term boost for battery-electric vehicles. We think that will be short term. We think there will be a shift to PHEVs.

I've included data from a survey here that KPMG does with auto executives every year.

Surprisingly, I think the downsizing of vehicles, turbo charging, things like that is included in there, these power train technologies.

The question was what are you investing in over the next couple of years effectively to comply with regulations?

And, you know, you see a very close second there is plug-in hybrid. So, these are there near-term investments which, in the time frame of that survey was three to five years, I believe. So, you have a very strong interest from auto executives in plug-in hybrid technology.

So, that's what's driving our forecast with the shift towards PHEVs more so than BEVs. No particular disdain for one or the other.

We did look at electricity in heavy -- we considered electricity in heavy duty applications. Ultimately, we did not include -- we did review it, but we did not include any electricity used in on-road applications in medium duty or heavy duty.

There are demonstration projects out there. L.A. Metro is demonstrating three electric buses. So, again, this is not to say that it's not possible, we just didn't think that it was going to make a very significant contribution to the LCFS, again which was the scope of our study.

We did look at off-road applications. I won't get into that too much. But again we do think that to the extent that off-road applications make a contribution towards the transportation energy scenarios that the Energy Commission is considering that electricity in off-road applications is something that needs to -- should be on the radar beyond forklifts. Forklifts are important and they are probably one of the -- like have the highest demand in terms of electricity pull, but there are others that are likely to increase in the future.

So, I kind of went through a lot there. I don't if we're taking -- I think we're taking -- am I taking questions now?

All right, we'll take questions there, so start from the dais first.

COMMISSIONER MC ALLISTER: I think we're going to keep things rolling.

MR. SHEEHY: Good.

COMMISSIONER MC ALLISTER: Yeah, no, but that was really informative. Thanks very much. And we may have questions for you as things proceed, so stick around.

MR. SHEEHY: All right.

MR. OLSON: Okay, and just to repeat that we're going to -- questions from the audience and from the online we'll do at the end of the morning.

If the Commissioners would like to raise a question, you're welcome to after every speaker, that's up to you.

Our next speaker's Allen Schaeffer. And his presentation is a little out of order. Originally, we were putting all the vehicle information in the afternoon, but he has a travel constraint and we decided to see if we could get him to do this presentation in the morning and he’s agreed to do that.

Allen is an executive with the Diesel Technology Forum and has some pretty interesting information on trends and diesel technology. So, Allen please come up.

MR. SCHAEFFER: Thank you very much, Tim, and good morning Commissioners. Thank you very much for the time this morning and it’s great to be here in California, and at the forefront of thinking about energy and transportation policy and actually doing about energy and transportation policy.

This morning I’d like to share with you a few introductory observations about diesel and technology, and then share with you some new research, both on light duty diesel vehicles and heavy duty vehicles. And then some final concluding remarks.

I’ll say at the outset, while diesel engines power a significant portion of many sectors of California’s economy, including non-road, farm, and construction, marine and power generation today’s comments and our research will focus only on on-road light and heavy duty vehicles.

First, I would be remiss without recognizing the Diesel Technology Forum members, who are the true leaders in clean diesel technology, representing engine and equipment manufacturers, fuel suppliers, and emissions control technology companies. So, we thank them for their leadership and support of the work of the Forum.

Just to be clear about what we're talking about today, there are many definitions thrown around in the light duty and heavy duty world, but for the purposes of our presentation we're going to look at light duty diesel vehicles as passenger cars, SUVs, light trucks, and the heavy duty diesel pickup trucks, heavy duty pickup trucks that have a diesel engine option and vans as well.

And our basis for doing that is because, while many of these vehicles are used for work applications, they're also used for personal transportation, recreational vehicle activities, et cetera, so we felt like that was a reasonable representation.

Heavy duty vehicles is basically everything else, medium duty and on up through Class 8.

Let's focus on light duty vehicles for a start. We did an analysis looking at the Polk registration data for the last couple of years, from 2010 to 2012, and found that diesel car registrations have increased nationwide by about 24 percent during this period.

Hybrid technology was up 33 percent. So, you can see the trends are quite significant for more people buying and using clean diesel cars here.

The breakdown shows you where they are; the total diesel population in the green line at the top, and the pickup trucks, and on down the list there.

In California, Californians are embracing new generation of clean diesel technology. Our analysis showed that California ranked number one nationwide for numbers of diesel vehicles registered last year.

And California also has the distinction as the fastest growing state for registration of new, clean diesel cars. So, clean diesel is definitely being embraced by Californians for its fuel-saving performance, and other attributes which we might cover in a moment.

Now, I'd like to turn to the research that we did, that's available now. We commissioned the Martec Group, based out of Michigan, this was an economic and market research consulting firm, to undertake a series of analyses for us and provide this information you're about to see.

The objectives on the light duty side were very simple. First of all, we wanted to understand what fuel savings and CO2 benefits have already been achieved since 2005 for the introduction of the newer generation of clean diesel technology. What do those mean for California and nationwide?

Secondly, we wanted to look in the future. What are the potential further gains for clean diesel technology being used increasingly in passenger car applications? What does that mean in terms of fuel savings and CO2 benefits, both for California and the nation?

I should be clear, and then finally we wanted to take that analysis and look at what would happen if we used an increasing blend of biodiesel fuel in those vehicles.

And I should say that our benefits, and the way we're calculating this, so the fuel savings of diesel over gasoline. So, it's the conscious choice of a consumer to pick a diesel car instead of a gasoline car in this case of light duty.

So, let's get into the results. On a national basis the savings that have been achieved since 2005 amount to about 1.2 billion gallons of fuel saved.

And you can see from this chart here the bulk of that has come from the heavy duty pickup trucks. Those consumers who picked the heavy duty diesel engine option when they were in the dealership, looking at a Silverado, or one of the Ram trucks, or the heavy duty or Ford vehicles, they picked the diesel over the gas option. What did they save by doing that?

We’ve also got the number of models of vehicles across the bottom of the scale here, the X axis. Starting in 2005 there were only 11 choices, basically, for consumer. And at the end of the day, in 2012 there’s about 19. So, the number of choices is growing quite dramatically.

So what does that selection of diesel mean in terms of fuel savings and benefits? It translates, as I said, into about 1.2 billion gallons of gasoline, 29 million barrels of crude. And this equivalent to basically taking 1.6 million vehicles off the road for a year, that’s the volume of fuel savings that this very small kind of decision by people to buy diesel cars has impacted the transportation and energy system.

This also accounts for roughly 11 percent of the strategic petroleum reserve.

So, the choice to use clean diesel over gasoline can be quite powerful in terms of energy savings.

Let’s take a look at what it means for California, specifically. So here in California, looking at the same time frame, 2005 to 2012, the total savings for diesel vehicles, again the light duty vehicles being used in California, it's about 700,000 tons of CO_2 during that time frame, 110 million gallons of fuel saved.

So, quite impressive results and, again, the bulk of the savings are coming from the more -- the greater penetration of the heavy duty pickup trucks, primarily.

And we'll talk about what the future mix looks like there in just a moment.

We also looked at what does this mean for the individual consumer because that's been pointed out. It's great to have technologies that might produce benefits and might produce savings in the future. Diesel vehicles are producing those savings today for consumers, and that's why they're embracing them so dramatically.

So, the next three slides are just some examples of that. So, if you have a diesel car, on average you're filling up nine times less each year, and over a 54-month period that's 40 fewer trips to the fueling station, dollar savings of about $1,500 in a 54-month ownership.

Our baseline here is looking at gasoline at

$3.59 a gallon, and diesel at $3.85.

If you're buying a diesel option in a light duty SUV, you're looking at a carbon footprint reduction by about three and a half metric tons and a savings of about 860 gallons of fuel over a 54-month ownership period.

And finally, those in the heavy duty pickup truck space are saving the most, about $5,600 in fuel costs over the 54-month ownership cycle, and 1,900 gallons of fuel saved compared to a gasoline option.

So, that was the past on the savings on light duty diesel.

Let's look at the future. So, I'm going to start with a little bit of perspective about this. Obviously, the primary driver for that mix of fuels and technologies from a global basis are CO2 standards, and this chart represents where a number of those international trends are taking us, with the U.S. represented there in the darker lines and kind of the outer bound there.

And you can see that we're going to have some alignment with the European regulations later in the 2020, 2021 time frame, I guess it is. And the European's, of course, have embraced diesel technology quite considerably over the last number of years.

In fact, beginning in 1998 there was a voluntary commitment by manufacturers in Europe to bring more diesel cars in as a result of their agreement to meet lower CO2 limits by 2012.

So, this introduced some advanced technology, such as high performance fuel injection technologies, and the widespread use and greater innovation in turbo charging.

So in Europe, for example in 2000, I guess 2010-11, the last line on this -- dot on this chart, more than half of consumers, when they bought a new vehicle, bought one with a diesel engine option.

Here in the U.S., you know, we're looking at about a 3 percent overall today of the total number of registrations.

But you can see in Europe diesel has been quite a strategy to reduce CO2 emissions.

Part of the success for the future of diesel depends on the choices of vehicles available. And today we have twice as many choices, basically, as we had in 2000, and that number is going to go up quite dramatically. And we anticipate a more than doubling of the choices for consumers across the full range of vehicles, from passenger cars on up to the heavy duty trucks, SUVs, and some light pickup truck activity, as well.

And just looking at the vehicles that are available today, you can see that some of these models are quite popular in the diesel version. For example, the Volkswagen Jetta, almost half of all Jetta’s sold today are sold with a diesel engine option. And you can see the Passat also has quite high performance.

So, diesel market share on the left, the volume of those sales on the right, and the models on the X axis.

So, as more vehicles comes into the U.S., we’re expecting to see more activity here. And, of course, these are the most popular models that are available today.

So let’s look forward now about the future. We made some assumptions about what the market might do. We took -- we’re not forecasters at the Diesel Technology Forum. There are a lot of people that are.

So, we took, I think, a reasonable approach. We had a conservative estimate of about 4 percent penetration of diesel vehicles.

Our baseline for this analysis and what you’re going to hear my comments on going forward are for a 7 percent scenario.

And then there’s an aggressive scenario where by

2020 diesels represent 10 percent of the new light duty vehicle sales.

So, let's take a look at what this means. In California, those same assumptions apply, so that would mean about 130,000 new diesel sales per year here in the State by 2020.

So, in terms of fuel savings what does that level of penetration mean? And here you can see for California we're looking at a savings of anywhere form 165 million to 240 million gallons of gasoline if we see that penetration of diesel cars over the next seven years.

The U.S. overall, I should point out, I didn't show the national slide here, but the savings, looking at that seven percent on a national basis is 1.3 to 2.1 billion gallons of fuel saved. So, we're looking at it from a national perspective as well.

If we break that down further, in passenger cars you can see anywhere from 21 to 63 million gallons as more passenger car choices come into play.

If we look at the light truck component, we're looking at anywhere from 18 to 54 million gallons of gasoline saved.

And then if we looked at a national perspective about the use of biodiesel fuel we would see some additional benefits of 150 to 300 million gallons of fuel displaced above and beyond these choices of diesel in these vehicles. So, biodiesel makes the diesel equation better in terms of fuel displacement and energy savings.

So just to summarize, and this is the national perspective here, we've talked about the savings going forward, as much as 1.2 billion gallons of gasoline. Conservative estimates in terms of the light duty vehicles there, about 7.7 million tons of CO2 and we can look at additional savings of 260 million gallons of gasoline for a B5 blend of biofuels in the diesel pool nationwide.

Now, I'd like to turn to heavy duty vehicles and finish our presentation this morning. And the remainder of the remarks will focus only on medium and heavy duty trucks, as I outlined in the beginning.

So, for the heavy duty part of this research we took a little bit different tactic. We wanted to understand the penetration of the new generation of clean diesel technology in the trucking population today.

And that means anything that's on the road that's 2007 and newer. That's an important year, as you know, from an emissions perspective and we felt like it would be good to know how many vehicles out there are actually embracing and using this new generation of clean technology.

We did not do a market penetration look at this because diesels already power over 90 percent of all the commercial vehicles out there, and so market penetration issues for us were less of an interest.

And we wanted to also understand, of course, the air quality benefits, and the CO_2 and fuel savings as a result of the use of this newest technology.

And then we give you some specific examples of some segments of the trucking world here at the end.

So, let's get into taking a look at the heavy duty benefits. Any discussion about heavy duty diesel trucks, particularly in California, must begin with a discussion about emissions. And the progress that's been made over the last decade plus is nothing less than dramatic.

In terms of the reductions, we're now at a level where diesels are near zero emissions and almost equivalent to the emissions from natural gas, which enjoys only a small, a very small advantage of NO_x emissions.

And this is really quite an accomplishment with the industry, and the Air Resources Board, and EPA, quite a cooperative journey that we've been on.

And we've got this great new technology that also is still very energy efficient. So, the question is how do we use that in the future?

Our analysis of the registration data and understanding what penetration is out there gave us some interesting findings. About 20 percent of the 2012 fleet that's out there, so these are all trucks that are registered today, are powered with the new diesel engines built after 2006.

So, the trucking industry's replacing and upgrading their technology with the new low emissions and more fuel-efficient diesel engines as -- on a reasonably good rate.

Here in California, California ranks third nationwide in the percent of all diesel trucks that are 2007 and later model year. And 2006, 2007 that's the time frame for ULSD nationwide and I think it's the same -- we're looking at the same reference point there.

So, California ranks third, so it's quite -- the new technology's being embraced here in California, as well, for the medium and heavy duty vehicles.

The technologies that have been deployed to meet these low emission requirements you're familiar with, I believe, and the blue band here represents the clean diesel technology that's introduced back in the '07 time frame, primarily using exhaust gas recirculation, advanced emissions controls, particulate filters, et cetera, a lot of inside-the-cylinder work.

And, of course, our key for this is ultra-low sulfur diesel.

2010 saw the introduction of selective catalytic reduction, or SCR. SCR technology provides the ability to even get further gains in emissions and fuel savings for engines, as we'll see in a moment.

I want to point out that the end-use emission rates for the 2010 and later-year trucks have dropped by over 90 percent since 2007.

Because as we talk about making further gains in fuel efficiency and lower CO2, we cannot walk away from the need for continued improvements to clean air.

And continuing to meet very low NOx and near-zero emissions is critical for California. And sort of on the other side of town here they're still worried about meeting clean air standards for ozone and particulate.

So, these are some examples of what real-world, actual end-use emissions are looking like from a number of different categories of vehicles, different classes, from a Ford F450 on down to a Class 8 Freightliner

Cascadia.

So, you can see the dramatic reductions in NOx and PM emissions during that time frame, from 2007 through 2010.

So, if we looked at the fuel savings and CO_2 benefits from the new technology and most of these benefits really start to apply to the 2010 and later model years because of the use of selective catalytic reduction technology, as I outlined earlier.

So, those vehicles, so far, have saved about 5 million tons of CO_2, and these are national numbers, about 5 million tons of CO_2, 560 million gallons of fuel, and that's 13.3 million barrels of oil.

So, quite substantial savings already and we're only two years, now three years into the adoption of this new, advanced technology for heavy duty vehicles.

And in terms of emission benefits, while achieving those fuel economy gains they're also reducing, by about 1 million tons of NOx from the air, and this is quite significant, here for California, particularly.

To put all that in perspective, the 1.9 million heavy duty vehicles introduced from 2007 to 2012 have saved about 13.3 million barrels of crude on a national basis and a million tons of NOx.

And this is equivalent to taking 1.2 million light duty vehicles off the road for one year. And we've done some other interesting comparisons there.

Also, it is equivalent to removing the annual CO_2 emissions from 1.6 coal-fired power plants.

So, the NOx reductions, and air quality benefits and CO_2 benefits from the newest generation of diesel technology is significant and will continue to accrue as more of these vehicles hit the roads.

So, for the diesel buyer this is also significant. The trucker, of course, is worried about the bottom line, perhaps more than anyone. So, new clean diesel engines in Class A trucks are saving them about $3,500 a year in fuel costs.

For a tractor driving 125,000 miles it's a savings of about 875 gallons of fuel. And the emission savings, as you can see there, outlined in this graph.

For a Class 7 vocational truck, savings of about 3.1 tons of CO_2 per year and other benefits that you see here, as well. That's 310 gallons and an additional $1,200 savings at $4-a-gallon diesel.

And finally, in the pickup and delivery space, these vehicles have achieved about a 20 times reduction in real-world NOx emissions with the newest generation of clean diesel technology.

So, California needs lower NOx technology and the clean diesel trucks are delivering that.

I would also want to point out that the industry is certainly not standing still when it comes to further improvements in air quality, and reductions in fuel economy and CO2.

As many of you know, EPA and NHTSA have hammered out an agreement to reduce by 6 to 23 percent fuel consumption from these vehicles beginning in 2013 through 2018.

The manufacturers have already announced that they've generally met the initial phase one of that, and that's due to a combination of vehicles and -- excuse me, engine and vehicle technologies that were already available in many cases, or on the shelf that could be more widely deployed.

The second phase is getting more challenging, of course, as we look to get even further reductions in fuel economy, while not sacrificing NOx emissions.

And I think many of you in this room are familiar with that tradeoff. That the more that's done to lower emissions of NOx creates competing forces for getting greater fuel economy gains from the engine.

So, it's been a fine balancing act for over a decade and that gets far more complicated now going forward.

And any further changes in NOx emissions will potentially challenge the ability to meet those future fuel economy targets outlined at the Federal level, and what you need here in California.

So, continuing to maintain a thoughtful balance between NOx and CO2 interest is going to be paramount going forward.

So to wrap up, let me just conclude by saying that the transformation of diesel to a low-emissions, clean technology, its significant penetration in the key sectors of California’s economy, and its inherent energy efficiency, all three of those things position diesel to play a key role in meeting the future greenhouse gas and clean air objectives here in California.

There’s significant fuel savings and benefits that are accruing today from existing clean diesel engines and have saved California more than 2 and a half million barrels of oil, and .7 million tons of CO2.

By using more diesel in passenger cars, light duty trucks, and SUVs we’re going to see even further savings in the future.

On a national basis, these estimates looking forward could amount to about as much as 1.3 billion gallons of gasoline and with the use of biofuels, a savings of 260 million gallons of gasoline above and beyond that.

On the heavy duty side we've just talked about the penetration of the new technology and what that means in terms of fuel savings.

For California, just to put a concluding point on it, we're looking at a savings of the light duty vehicles that has been achieved, about 1.2 billion gallons has been saved. The future looks like we could be saving anywhere from 165 million to 240 million additional gallons as more people invest in new clean diesel passenger cars, light trucks, and SUVs.

And we've got about a 21 percent penetration of the newest, most fuel-efficient, heavy duty clean diesel vehicles on the road today in California.

So, with that I'll just conclude by observations from others that are far more knowledgeable and study these issues, and their perspective about the future of diesel as a global transport fuel.

And I would call your attention, if you're looking for more details and interest about the light duty vehicles to check out the *New York Times* from two weeks ago. The Sunday edition had quite a dramatic portrayal of diesel cars. And the review there I think was quite informative.

So with that, thank you very much for the opportunity and we'll be happy to answer questions at the appropriate time.

COMMISSIONER MC ALLISTER: Thanks for that. That was really informative. In fact, my mother just recently bought a diesel Jetta, so we're on trend, I guess.

Let's see, so clearly a lot of benefits. I guess, you know, I'm interested in the next panel that's going to talk about biofuels because I think that's a really key component here. Because when you start counting the molecules and you look forward, you know, it's not clear. You know, clearly, we have to make a wholesale kind of transition over to more renewable fuels for whatever engines, but particularly for diesel engines.

And so I guess I, personally, am interested in hearing about kind of the potential for lock in into technologies, and then sort of how much risk that produces for us down the road if, you know, scenarios kind of evolve in the direction where there's not enough biofuel and we sort of have these vehicles.

Presumably, their life isn't forever so, you know, eventually we could still jump tracks if we had to.

But I guess, you know, the interactions between all of these different vehicle types, so maybe you could just comment at a very high level on that.

MR. SCHAEFFER: Sure.

COMMISSIONER MC ALLISTER: I think probably we'll get into that a little bit later, as well.

MR. SCHAEFFER: Sure, just the diesel industry embraces the use of higher blends of high quality, renewable biodiesel fuels.

If you look at manufacturers today, pretty much all of the light duty companies are comfortable with a blend of B5, with some now allowing a blend of B20.

The newest one of those is the Chevrolet Cruze which is certified up to a B20 blend.

All the heavy duty pickup trucks that we pointed out here in this study, they can all use the B20 without any problems.

I think going forward to higher blends in other passenger cars, we need to be mindful of the issues of the durability of the emissions control technology and assuring that we have a high quality stream of biofuels that can interact favorably with those systems.

Because remember, the biodiesel can be used in any diesel vehicle that's out there today in these lower blends. So, it has great appeal because of the broad generation of diesel, you can get very quick savings and CO_2 reduction from larger uses of biodiesel, even at lower percentage blends.

The higher percentage blends are coming in some places. In some parts of the country B20 is more available than others.

But, certainly, the industry welcomes the use of more high quality renewable biodiesel blends in its products.

COMMISSIONER MC ALLISTER: Great, thank you very much.

MR. SCHAEFFER: Thank you.

COMMISSIONER SCOTT: I did have a question. That was a great presentation, thank you very much.

The question, I know your focus here was on the on-road sector. I know the non-road sector is also a large component of a lot of this. And I was wondering, I was interested especially in some of your summary slides where the trend of having, you know, like 20 percent of the fleet is now powered with the newer engines, or 11 percent of all the on-highway diesel engines have been built -- that are out there right now were the ones built after 2010.

And do you expect to see sort of that same sort of trend as the non-road engines transition to their newer, cleaner standards?

MR. SCHAEFFER: Yes, thank you for that question. The uptake, the adoption of newer generation clean diesel technology in the off-road machine segment, from a regulatory perspective has been following a time line that is lagged a little bit by the on-road folks.

Starting January 21st, next year, 2014, the largest engines will meet the tier 4 final regulations for the same kind of near zero NOx and PM levels that we've seen shown in the on-road sector.

The acquisition, and the uptake, and the use of those in the population is really dependent on factors such as economic stability and growth. And certainly, as construction starts to pick up, as our economy starts to recover more people will be buying construction and farm equipment to improve their operations, and they'll see the fuel saving gains come out of that as well.

We actually are undertaking a project to get at this question. It's a much more complicated question because we do not have the registration data available and the populations are somewhat uncertain.

And as the Air Resources Board and others have learned here in California, they're not necessarily always what you think they are in terms of how many vehicles are out there, but also how those machines and equipment are actually operating.

So, we are hoping to look at that circumstance of how many machines, equipment, engines, et cetera in the off-road space are using the newer generation of clean technology, which is taking a little longer and is going to be -- going to give us not quite as good of a broad level of information, but we should have some answers on that before the end of the year.

Thank you.

COMMISSIONER MC ALLISTER: All right, thanks very much.

MR. OLSON: Okay, so Commissioners, we're going to go into kind of a grouping of topics under biofuels and to begin that we've asked Mary Solecki from Environmental Entrepreneurs to discuss advanced biofuels.

Just a note, she also has a travel constraint and will have to leave by 11:00. So, if you have questions for her, please provide them at the end of her presentation.

So, Mary Solecki.

MS. SOLECKI: Thanks Tim, and good morning Commissioners. Thank you for reordering the agenda a little bit for me this morning, for my considerations.

I would like to thank everybody here for -- I came here in my Jetta TDI, powered with a B20 blend from Propel Fuels. So, directly thank you to everybody who made my transportation option possible, and for reducing my emissions. I did carpool as well, for what it's worth.

COMMISSIONER MC ALLISTER: This is the future we're headed into, right. It's a guilt -- transportation becomes a guilt trip, right, yeah, absolutely.

(Laughter)

MS. SOLECKI: So, I was glad to see that I was so up on a trend there, that's great.

E2 is a nonprofit organization. We're a membership-based advocacy group. And lately we have been taking quite a foray into some independent analysis, especially on the topic of advanced biofuels.

And that's what brings me here today is to talk to you about the analysis and the research that we've been conducting on advanced biofuels.

We are currently working on the update to our annual Biofuel Market Report. And in this report we specifically study, so I can set the scope properly, advanced biofuels that have a 50 percent reduction of carbon or greater.

So, in the past we used a somewhat confusing series of definitions that was more environmentally conservative. We blended a California definition with EPA. This year we're just using an EPA definition. And so, soybean-based biodiesel will fall under the scope of our review this year.

And so we're in the process of finalizing these numbers right now and so there's, unfortunately, a lot of information I'm not quite ready to put in front of you in black and white this morning, but I can at least talk to you about a lot of the trends that we're seeing, and I can provide some specific examples of the status of some of the companies that we've been looking at.

And as much as I can provide these generalizations, there are exceptions to every one of these generalizations that I'll make. So, I'm sure that any company could raise their hands and say what she said isn't true for my company, in particular. So, just have to make that disclaimer.

I can also provide more detail to you in a one-off basis, but we'll be publishing our report no later than August 27th, at the Low Carbon Fuel Summit that will be here in town. So, we look forward to sharing that information with you all then and there.

All right, as far as a sneak peak, what we're finding, overall the advanced biofuel sector is experiencing slow, but steady growth.

As a whole, a lot of the new technologies have proven themselves at a demonstration scale and now they're looking to take that next step into commercial production.

And that's the step that requires significant capital. And so they're having huge barriers in relation to raising that amount of capital needed for the new bio-refineries.

And so that's the step that the advanced biofuel industry generally is facing at the moment. And in my last presentation here, to the Energy Commission, I talked a little bit more in detail about the different, unique approaches that each company is taking to meeting these barriers.

The drivers of this growth are policy-driven demand through the RFS and the LCFS, and through customer demand from sources like the military and the airlines.

Regulatory certainty continues to be a huge barrier for this group. Both the RFS and less so the LCFS, lately, but the RFS is certainly under significant scrutiny at a Federal level as it's going before the Energy and Commerce Committee, and others for review this year.

There's a little bit of text in the latter half of the slide that, embarrassingly, shouldn't be there. That's what I get for making this presentation late on a Sunday. I apologize, that's left over from my last presentation to you all. Please excuse that.

Anyhow, as far as private investments, like I said the capital flow seems to be the big clutch here. And we are seeing big capital flow, that's the good news.

Last year we found $3.4 billion had been invested in this market about this same time. This year it's up to about $4.5 billion. I intentionally didn't put the total there in black and white for you because that number may adjust a little bit.

We're tracking companies that are active and are in North America. So, if a company has since filed Chapter 11 or anything of that nature, then we're no longer tracking that investment. So, this is just active investments.

And then the advanced biofuel production is really only half the story because the value chain is so important, the feedstocks, the enzymes, the distribution equipment and technology.

And so there's significant investment going on in this market as well, and that's totaling about $2.1

billion since 2007.

If you total these two together, that gives you about $6.6 billion since 2007, so in the last six years if I'm counting properly, seven years.

To review where we were last year, we were tracking 163 companies and they had a capacity last year of about 685 million gallons.

We were projecting that that was going to grow to about 1.6 to 2.6 billion gallons, that's our low and high end assessment of what the capacity might be in 2015.

And what we're finding is that that number was more or less on track. I'll get into that a little bit more in a moment.

But the number of companies that are still active in the market is almost completely steady since last year. We've got some additional biodiesel companies that we're now tracking, like I said because we integrated the soybean-based biodiesel because we're using the EPA definition, and they do qualify as a 50 percent reduction or better.

And so for that reason we're now tracking 202 companies. But other than that, for any company that was merged, or acquired, or filed a Chapter 11 there is another company that came into -- that not only came into the public view, but made significant commercial plans or announcements this year.

So, for every failure this year I can meet it with a success story as well, so I found that interesting.

I'll spend a little bit more time on this slide and this is where I can describe some more of the anecdotes that we've seen.

Even though there's only percentages right here because, like I said, I didn't want to necessarily put our final numbers in black and white quite yet, they're still subject to a little bit of tinkering.

But in 2000 -- this year what we're looking at is about a 12 percent growth in capacity form last year. And our numbers for 2015 that was 1.6 to 2.6 billion last year, we've narrowed that a little bit further. Now, we're looking at about 2 to 2.4 billion gallons of capacity in 2015 and a little bit more in 2016.

In 2016 the lion's share is going to be biodiesel, it's going to be about 1.8 billion gallons. That's just a little bit less than what the EPA will be calling for -- or the RFS will be calling for because of the share of renewable diesel that will be falling under there.

What's interesting is the growth of the

hydrocarbons, the renewable diesel and the renewable gasoline, that's outpacing the growth of the cellulosic ethanol, from what I can see.

I think this part is pretty interesting that by 2016 we're looking at about an equal market share right there. That's about 620 million gallons for each one of those types.

We're not tracking the corn ethanol, this is just cellulosic ethanol.

And what happens with the cellulosic ethanol is that there's going to be a few facilities coming online. We've got the Eneos -- at least across the country there's the Eneos Plant, DuPont and Abengoa. Those should be coming online in the next couple of years.

And then within California we've got the Canergy Plant that was announced and Edeniq is reporting about 7 million gallons of cellulosic ethanol.

But the big trend that's happening there is I think that we're going to see fewer brand-new facilities being built and it's going to be a lot of conversion of existing capacity.

There's processes like the Edeniq and the Sweetwater technologies. Others are providing some -- Bolton is a little too simplistic, but they allow them to process more than just the corn feed stock, but to accept a variety of cellulosic materials, and it's at a pretty low capital requirement in comparison to building an entire facility.

An entire facility can run about $150 to $200 million, but some of these advanced technologies just require in the range of $15 million.

So, it's a much easier way to take existing capacity and be able to lower the carbon intensity score.

And we're not tracking very many of those because a lot of that information hasn't been announced in great detail, yet.

And so it's possible that that ethanol number could go a lot higher, because if those technologies prove to be viable, the way they suspect right now, I think that that would be -- that that could grow gangbusters over the next few years for the corn ethanol market.

The hydrocarbons, as we've discussed a little bit here this morning, since they are -- they face fewer of the blending and pipeline infrastructure issues; they do have some barriers as far as some certifications. There is a lot of interesting growth happening in that sector.

KIOR, even though KIOR's currently producing ethanol today, they're going to be doing some of these renewable hydrocarbons in Mississippi.

Neste is importing about 100 million gallons this year, 300 million gallons in 2013 and 2014. They have reported that that's about 2.5 million metric tons of reduction, which is 45 percent of the LCFS this year and next year, which is pretty impressive.

Sapphire is doing some interesting things and I'm watching them closely to see what happens next with their capacity in New Mexico. But they're a California-based company and I think that they've got some interesting technology with their green crude that they're selling to Tesoro.

Some other hydrocarbon-based companies are Diamond Green and Emerald Biofuels, both in Louisiana. If you can keep the gemstones straight there, Diamond Green is a JV of Valero and Darling, and they're going to be producing about 140 million gallons of renewable diesel.

And so the way that they're overcoming that capital need is they've got significant backing through Valero and Darling.

And then there's Emerald Biofuels. They've got about 85 million gallons of capacity from Dow and Honeywell.

There was also an announcement this year for Altair. They're going to be producing -- they'll be coming online as early as next year with about 5 million gallons in Los Angeles. They're using the old Paramount facility, and it's an idle refinery. They'll be repurposing it. And over the next few years they're be scaling it up to about 30 million gallons.

So, 15 of that 30 million will be going to United Airlines. The other 15 will be sold into the -- I imagine into the California market. Maybe they'll decide to export it, but I doubt it.

And then there's the Dynamic facility that's in -- I'm lapsing, where's the Dynamic facility? It's in Louisiana, as well, I believe. And it's 75 million gallons. It's been online for a few years, now.

Finally, as far as that other number, Oberon Fuels has made some announcements about making renewable DME and they're looking at in-state production of that DME from biomethane and other natural gases.

So, that's a -- I'm sorry I don't have more of that written down for you, but I think that there's a lot of interesting things and companies that are happening within this market. And I'm happy to provide more detail on an individual basis, or after the presentation.

So, that's pretty much all I have for you this morning. I hope that was a helpful overview of the updates. And if you have any questions, I suppose now is the time since I'm taking off before too long. I'll be here for another half-hour or so.

COMMISSIONER SCOTT: I did have one, which was on your 2012 report review, and you had sort of the high and low scenarios, but biodiesel was the same across the high and low, what is that?

MS. SOLECKI: Yeah, that -- thanks for asking about that, actually. So, biodiesel, the capacity is much greater than that number that we're reporting right there. Their capacity is up, it's anywhere between 2.1 and 2.5 billion gallons, but their actual production is much lower.

Did I say that correctly, capacity is at -- okay and the production is much lower.

And so we didn't put the -- report their actual capacity because they're producing at this 877 million gallons in 2012 and that was excluding the soybean-based biodiesel last year. The total biodiesel number was greater.

Ryan can provide a little bit more detail there. And, in fact, Russ and Joe might be planning on doing that in a later presentation.

So, that one is a little bit of an anomaly and that's why it's not actually a low and a high. The actual production was at 877, so we didn't feel a need to have a variance there.

COMMISSIONER SCOTT: Thank you.

MS. SOLECKI: Okay.

COMMISSIONER MC ALLISTER: I just want to compliment E2 for all the work you do in this space, really a nice, nice job.

MR. OLSON: So, Commissioners, just another point here. When we recruited speakers, we were looking for people who could represent a whole range of companies and otherwise we'd need a three-day workshop, there was that much interest.

And we will try to itemize this in our analysis of our -- we are doing a lot of one-on-one meetings and interviews with other -- individual companies, too, so making sure we're not leaving people out.

We're pleased to have our next speaker, Plinio Nastari, join us from Brazil via WebEx. He is the President of Datagro Consulting, gathers information for multiple clients, including the government of Brazil, also worldwide organizations. He's an advisor to the government of Brazil.

And by the way, he organizes some of the best conferences on these topics in New York, Sao Paolo, and other places.

And he's an expert on alcohol fuel, specifically sugarcane ethanol and that's what we're asking him to speak about today.

So, Plinio, if you're on the line you can go ahead and start your presentation.

MR. NASTARI: Everyone can you hear me?

MR. OLSON: Yes, we can.

MR. NASTARI: Commissioners -- thank you -- CEC staff, participants, thank you for the introduction about Datagro that saves time.

Just to complement the information already given, we provide services to 41 countries, clients in 41 countries. We're a team of 85 people spread in six offices, including one in New York.

And we have been involved not only with market analysis and independent research, but also in trade negotiations and trade disputes at the ITC, and arbitrations in Brazil, and the ICC in Paris.

We have 11 business units, which is what we show here, and each one of these business units is involved with different aspects of the business and services that we provide.

We are going to be talking about Brazil. And just to make a reference of what Brazil stands today, taking note of data from 2012 Brazil accounts for 35 percent, approximately, of world's cane production. It's number one sugar producer. It's number two ethanol producer, second to the U.S., number one sugar and ethanol exporter.

And the Brazil has been able to achieve this market share with only 36 percent of its cane converted to exported sugar and 6.8 percent of its cane to export ethanol. And that's why it is such an important fundament to the world's sugar and ethanol markets.

In terms of energy, sugar cane is second largest source of primary energy in Brazil, 17 percent after oil and above hydropower. This cane production has grown after intensification of the diversification of production towards ethanol in the mid-seventies.

Now, another diversification process is underway from the use of bagasse and leaves for power, second gen ethanol and biogas, which is picking up strongly here.

And in these past four years the industry has suffered from the financial crisis of 2008 adverse climate, which reduced ag yields in recent years.

The feedstock gap you have, which existed until recently of 130 million tons of cane has been eliminated this year and now we see Brazil positioned to continue expanding production.

We're estimating cane crush to grow in ten years to 1.06 billion tons.

This graph shows the evolution of supply of total reducing sugars from Brazil since 1975, when this diversification process is started. It shows sugar, anhydrous ethanol, and hydrous ethanol used by the flex fleet, in total reducing sugar's equivalent. And it shows how it grew from 7.1 to nearly 86 million tons this year.

Just to have an idea of what 86 million tons represent, global sugar consumption worldwide is 166 million tons.

The gap, the feedstock gap which has been closed, is shown in this graph. You can see the gap in '11-'12 and '12-'13. And this is cane supplying the Centre-South region, which accounts for more than 90 percent of Brazil's supply.

The substitution of gasoline which has been achieved in Brazil from these figures is very large. You can see from this slide that since '85 cane production rose 8.3 times. Supply of total sugars 11 times. And the production of sugar 5.2 times, while the production of ethanol rose nearly 50 times.

Since 2003, when the flex car sales started, cane crushing rose from 358 to 634 million tons, nearly double. And sugar production rose 63 percent, while ethanol production rose 88 percent.

I trust that this information is going to be shared and available to participants later on.

In terms of substitution of Otto-cycle fuel demand, Brazil has been able to substitute nearly 45 percent of its gasoline by ethanol in gasoline equivalent. And this graph shows the relative targets in the U.S. The RFS2 target 20 percent by 2022, and the EU Renewable Energy Directive 10 percent, which is now eventually coming down to 5 by 2020, and how the U.S. and Europe have fared in terms of reaching those objectives so far.

Since 1975, Ethanol has substituted in Brazil 2.3 billion barrels of gasoline, a very relevant number considering the proven reserves of oil and condensates, including the Pre-Salt, which are today standing at 15.3 billion barrels.

This is a number which is growing by 120 million barrels every year without additional investment, simply because cane is renewable.

And the value of this gasoline which has been substituted, including the foregone debt, the service on the foregone debt which has been saved is nearly $280 billion, which is about 75 percent of Brazil's current foreign reserves, which is credited to be one of the reasons for the economic stability of Brazil.

In the past four years the issues affecting the industry have been the change in production systems from, basically, manual to mechanical planting and harvesting, which in the short term have brought higher losses, a need of greater investments, and higher costs in the short term due to climate problems.

A large cane planting effort is underway, which has shown as been achieved.

And the production has been impacted by unusual climate, which is now coming back to normal this year, 2013.

And these pictures show, essentially, the old methods of planting and harvesting and how the industry has moved quickly into mechanical planting and harvesting. And in the Centre-South region we are moving close to 87 percent mechanical harvesting already. By 2014 it should be completed, the peripheral being achieved for a complete substitution of manual harvest.

180 plants in Brazil are already accredited by the USEPA as suppliers of Advanced Bioethanol, out of 441, and 28 installations are certified by Bonsucro,

supplying ethanol and sugar to the EU. There are only two other plants in Australia, besides these 28 in Brazil, certified by Bonsucro.

A very interesting point is that cane ethanol functions in a closed circuit of soil nutrients. The only thing which has been exported by the mills are carbohydrates, the sugar and ethanol, which are molecules with atoms of carbon and hydrogen. So, all other chemicals, chemical elements such as nitrogen, phosphorous, potash, calcium, magnesium, sulfur and other micronutrients are recycle thru the byproducts, vinasse, ash, filter cake, which are returned to the soil.

And this build-up of material is what makes cane build up soil over time, which is a very important factor for sustainability.

the industry’s moving towards the economic use of tops and leaves and by doing that will enlarge production and income from the same production days. One of the methods of showing that is the potential for cogen from bagasse. This potential is very large in the southeast of Brazil; it’s close to 20,000 megawatts.

Just to have an idea, the average energy consumption in Brazil is 53,000 megawatts, average.

And you can see in the other regions. And it’s exactly located in the areas which are more densely populated, where energy is consumed.

The relevant fact is that mills are currently using efficiently only one-third of the energy in cane, the sucrose bar. Bagasse is being used inefficiently in tops and leaves and until recently were wasted.

And the industry is now in the process of utilizing bagasse and leaves more efficiently for power, for second gen ethanol, and also for biogas.

And studies developed by the University of San Paolo show that the biogas production has a huge potential impact since the production of biogas in formation into biomethane or green natural gas for substitution of diesel could be very effective. Only 50 percent of the leaves being diverted to biogas would mean enough biogas and biomethane that only 5 percent of this biomethane would be enough to substitute all diesel use by the entire sugar and ethanol sector.

And this would bring the savings in greenhouse gas emissions close to 98.5 percent, according to this study at the University of San Paolo.

We know that sugarcane ethanol is a very good way of saving greenhouse gas emissions. According to the Brazilian scientific studies, it’s 90 percent and over savings.

According to the EU read, without iLUC, 71, and the RFS EPA study, including iLUC 61, and it could be 91. And this study from the University of San Paolo indicates that it could got to 98.5.

The projected demand for cane that we have until 2023, using conservative assumptions on the potential expansion of sugar and ethanol indicates that the markets will continue asking for more products.

So, considering 20 percent usage of hydrous ethanol in flex fleet, and a stable market share for Brazilian sugar exports, we have this projection of 1.06 billion tons of cane in ten years, which we see that can be met by all of the initiatives of not only new plants, but also better use of cane residues as they stand today.

The forecast for Brazil's sugar and ethanol demand is show here in a summarized way, in million tons of total reducing sugars. And ethanol exports is in light blue there.

And the proportion of exports of sugar and ethanol in total production, as a percentage of total reducing sugars, is shown in this slide.

And you can see that ethanol exports as a percentage of total production has risen from 1 percent in 2000 to 11 percent in 2008. It has fallen to 7.8

percent in 2013, and it's projected to reach 14.7 percent by 2023.

Exports of sugar and ethanol accounting for, combined, for 18 percent of production by 2000, 42.9 percent this year, and are projected to grow modestly to 44.6 percent in ten years.

We are projecting total reducing sugars to reach 150.8 million tons by 2023 from the current level of 85.7. You can see what they were in 2000, 37.2.

Sugar cane for sugar and ethanol rising from the current 634 to 1.06 billion tons.

And ethanol exports, this is the historics in 2000, 2005, 2013 estimate, and the estimate that we have for 2023, in million cubic meters.

Mr. Olson advised me that we should make a reference of the conversion factors between cubic meter and gallons, and here they are. So, 1 cubic meter is 1,000 liters. One U.S. gallon is 3.7 liters. So, 1 cubic meter is 264.17 gallons.

Well, with that the potential ethanol exports that we are projecting for the next ten years is 3,000 -- or 3.48 billion gallons by 2023, from the 1.35 billion gallons in 2005, and 1.08 billion gallons this year.

We see that bioethanol is being priced at a price which is lower than what it should. It should be referenced to the price of toluene, not the price of gasoline.

Ethanol has characteristics as a fuel that -- and a few additive that should be compared to toluene, not gasoline.

And the fact is that toluene has a market price which is between 30 and 45 percent higher than the price of gasoline, depending on the market and the time series length.

And in our view regulation that recognizes the environmental benefit of ethanol only internalizes in market prices and have the opportunity of doing it -- internalizing market price in the inherent value of ethanol as fuel.

And if that happens, the share of total exportable surplus dedicated to ethanol could rise towards more ethanol as sugar in the future.

And this slide shows the evolution of the price of toluene and gasoline in Rotterdam and in the U.S., showing the premium of 30 percent in Rotterdam and 45 percent in the U.S. in the ag series that have been analyzed.

Brazil has been a major exporter of ethanol to the U.S. In this table we show Brazilian exports to the

U.S. since 2003, the last ten years. And you can see that, you know, it's a very stable flow. It changes a lot over time. And we can see that it's because the imports of ethanol from all origins into the U.S. has been changing a lot over time, which is the second column in this table.

And you can see also imports from all origins to California in the last column.

Here we are showing exports from Brazil, from CBI to California in the last ten years. And you can see that combining direct Brazil and CBI exports into California, and CBI ethanol is mostly hydrous ethanol from Brazil, reprocessed into CBI, you can see that Brazil plus CBI to California is pretty much the sum of all origins to California.

So, California's being supplied by Brazilian ethanol direct or indirectly through the CBI over time.

We can see that these projections, they are justified by the land availability. Today cane occupies 9.8 million hectors after 65 million hectors possible for cane, according to the agroecological zoning, which was carried by the Brazilian government.

Cane does not grow in the Amazon region. It does not grow in the Pantanal area. And the government had the trouble of doing this agroecological zoning and decided to prohibit the plantation of cane in areas which is not authorized.

But, really, there's nearly zero cane in De Bio Mos, which are protected, which is the Amazon and this land of Pantanal.

And the potential estimating by the zoning, 65 million tons -- million hectors, out of the 9.8 million hectors which are currently in use.

If we look at the land used in Brazil, and Brazil has a total area of 851 million hectors, native vegetation is 554, which is 65 percent of the territory. Land in actual use is 260 mil hectors, and other uses, which is roads, cities, 38 million hectors.

Well, you can see that what is being used, 260, 200 is pastures, crop land is 60, cane is 9.5, 9.8 out of these 60. And cane for ethanol is 4.6, which is half a percent of the land.

The growth which has been observed in area is basically coming from pasture, as you can see in this slide. And the fact that each hector of cane can bring together one-sixth of a hector for food production into cropping, and this is supported by research and surveys which are being done here very carefully.

The issue of whether the fact that Brazil's cane is subsuming pasture is forcing cattle to go into the protected biome falls off this argument when we look at what is happening with pasture area, and you can see that pasture area is all actually falling, while the herd is growing, and meat production is growing.

So, the pasture area is falling by minus .14 percent, while the herd is growing by nearly 1 percent per year, and meat production is growing by 2.64 percent. Essentially, productivity in cattle raising from pasture is improving a lot and so the argument that the displacement of pasture by cane is forcing pasture into the Amazon is not true.

The final demonstration of this comes from the observation that the deforestation rate of the Amazon has fallen by 83 percent, while shrinking areas has continued to expand in pasture.

In the past 38 years agroindustrial yield in this industry has risen threefold, but the potential is to double until the end of the decade, and quintuple in the long run. This is the actual agroindustrial use curve. It moved from 2,000 liters per hector to 7,100 liters this year, a rate of increase of 3.36 percent per year.

And the potential is for it to go beyond 30,000 liters per hector by 2030.

The final message, well, investments tend to concentrate on increased energy efficiency, cost reduction measures. The industry is changing rapidly with investments in mechanization and more efficient transportation infrastructure in rail and pipeline.

The supply of sugar and ethanol will grow from large stock of productivity to be implemented in the use of cane residues until recently have been wasted or burned.

We see ethanol is still being underpriced for its superior qualities as fuel. And regulations should aim at internalizing enterprise of these positive externalities.

There's a large area available for expansion of cane in Brazil and other cane-producing countries. And we see as Brazil as serving as demonstration, in fact, for initiatives in other places, like Columbia, Peru, Paraguay, Argentina, Dominican Republic, El Salvador, India, Thailand, Angola, Tanzania, Zambia, and others which will soon be participating in an enlarged world ethanol market.

And, actually, we are helping some of these countries, helping them establish their regulations and choice of technology to do that.

So, thank you very much, that's the closing. These are some of the agenda of our future conferences, if you are interested.

MR. OLSON: Thank you very much, Plinio. And if some of us in the room didn't have all of your slides, if you're willing to give us your updated Power Point that would be beneficial, if you can e-mail that to us.

MR. NASTARI: Sure.

MR. OLSON: So at this point, Commissioners, you have questions?

COMMISSIONER SCOTT: I do have one question. Thank you very much for calling in and giving us this great presentation over WebEx.

The question I had for you, this is Commissioner Janea Scott, is on a slide kind of in the middle of your presentation where you mention that Brazil is the major exporter of ethanol to the U.S. And then it shows the fluctuation of the amounts of ethanol that have come to the U.S. from Brazil.

And I remember at the beginning of your presentation you mentioned that some of the crop yields had dropped, but I was wondering if there were other -- what you think some of the other reasons are for the fluctuations year to year.

MR. NASTARI: Thank you, Commissioner Scott.

Well, the reason is basically because ethanol trade is still in its infancy. And fluctuations are a reflection of the needs of import in the U.S., and eventually the availability of product in Brazil and elsewhere, but mostly the fluctuations in the needs of imports in the U.S., because the trade in proportion to total demand is still small.

We believe that this tends to increase as the trade barriers have been lifted. And we should see a more increased trade in the future.

But, essentially, that's what happened.

COMMISSIONER SCOTT: Thank you.

COMMISSIONER MC ALLISTER: This is Commissioner Andrew McAllister, I do have a question. But first, (speaks in Portuguese) --

I have a question about the hierarchy, really, between sugar production and ethanol production. If I'm an owner of, you know, property with cane on it, what's my priority? How do I get the most value out of that as far as, you know, do I extract as much sugar as I possibly can, and ethanol is what's kind of left over, or what's my business value proposition for that property, that crop?

MR. NASTARI: Thank you, Commissioner McAllister. Today approximately 50 percent of the cane is diverted to ethanol and 50 percent for sugar in Brazil.

And Brazil has created a system whereby feedstock producers, cane producers participate in the bonus and onus, the benefit and the -- the good times and the bad times in the price of end products.

Which is a system which provides stability and it's a system which is not seen very often worldwide. Very often, governments intervene and establish the price of feedstock irrespective of the price of end products.

This system that is in place in Brazil is completely market driven. There is no government interference. And the value for a cane producer comes from the price of sugar and ethanol.

So, when the prices are good, the prices of cane are good. When prices are not so good, the prices of cane are not so good. And that's what brings the driving force for people to keep constantly looking for higher productivity rates.

And that's what we see as the motivation for the productivity increases that have happened, you know, in such an important level in the past few years.

COMMISSIONER MC ALLISTER: But you could see the percentages of sugar versus ethanol out of a given property change over time depending on marketplaces, I guess that's what I'm hearing you say.

MR. NASTARI: Oh, yes.

COMMISSIONER MC ALLISTER: Okay.

MR. NASTARI: Yes, there is flexibility in the proportion which can be diverted to sugar and ethanol. And this flexibility is at the industry level, not at the farm, of course.

But there is certain flexibility and depending on relative prices mills can ship more product into one or other product if prices are more interesting.

And that’s what I referred in my presentation. You know, if ethanol received the price referenced to toluene, not gasoline, certainly we would see a higher proportion of the exportable surplus going for ethanol instead of sugar.

COMMISSIONER MC ALLISTER: Okay, great, thank you very much.

MR. OLSON: Okay, thank you very much, Plinio, again for spending the time and participating from several thousand miles away.

MR. NASTARI: Thank you.

MR. OLSON: Hopefully, you can stay on the line. We will have some other public comments at the end of the morning here, within the next hour. If not, we can just contact you at a future date.

MR. NASTARI: Thank you. I’m available, I’ll be glad to respond to any questions. I can stay until 4:00 p.m. Brazil time, which is for another hour. So, I'll be glad to be listening carefully.

MR. OLSON: Thank you very much.

We'd like to go to the next speaker, now, and this will be kind of a tag team match here with Russ Teall and Joe Gershen who represent the California Biodiesel Alliance, and get their insights on a lot of in-state production of projects.

MR. TEALL: Thank you, Tim. At least we weren't called a Mexican tag team. I would have been Nacho Libre and Joe would have been somebody else, I'm not sure. And I didn't bring my leather helmet so --

Anyway, we're here today to, you know, address a pretty simple question as Tim said in the middle -- in the beginning, but it's a pretty complex answer, you know, to get down to it.

We're going to cover, basically, three different topics in only seven slides, but it's fairly dense. And so we'll do an overview of it and kind of describe the methodology we went through.

But really to get the full import of it, you know, will require further drill down and analysis.

My name is Russ Teall. I'm the President and Founder of Biodico Sustainable Bio Refineries. It's a private company. We develop projects in California, different parts of the U.S., and Australia.

I'm also the President this year of the California Biodiesel Alliance which is a trade association of California biodiesel producers, and stakeholders, and out-of-state producers that are interested in the California market.

And Joe Gershen, who's the Vice President of Marketing for Crimson Renewable Energy, and also the Vice Chairman of the CBA this year.

So, what we're going to cover, basically, is a census of what's going on with biodiesel in California right now, a survey that we did that was recently released, and then talk about the metrics of biodiesel.

The map that you see to the right of the screen was actually put together by the Environmental Defense Fund. They're doing an independent analysis of biodiesel infrastructure in the State.

This is a draft. It's a work in progress. And their final brochure, and maps, and graphs and analysis should be available in the next 30 days or so, and we're looking forward to that.

What I found of particular interest was the graph in the upper right-hand corner. And you see an increase in biodiesel production and then a drop into the valley of death, as they say, before recovering.

And the analysis on that basically comes from CEC numbers, from Gary Ell's shop, was that during that period of time the government incentives, especially on the Federal level, were on again/off again.

You know there was problems with the RINs in terms of fraud. The subsidies were on again/off again year by year, frequently in a retroactive manner so that there was no direct stimulus to production.

And it's kind of a illustrative story of what goes wrong when government fails to send a consistent signal.

Okay, the biodiesel census, basically in 2012 there were eight in-state biodiesel production facilities, producing about 16 million gallons a year.

The capacity was slightly less than 40 million gallons a year, so there was about a 40 percent utilization.

In 2013 a couple of new facilities came online, nine to ten is our best estimate, with a production estimate of about 26 million gallons a year capacity of slightly less than 60, about a 43 percent utilization.

So you see about an 8 percent increase overall in utilization but, still, a tremendous amount of underutilization which in part led to our survey to find out why are these plants being underutilized.

If you compare this production to the amount of diesel fuel consumed in California, which right now is about 3.3 billion gallons a year, the blend percentage of biodiesel would be .5 to .8 percent, so very, very small.

If you focus on the low carbon fuel standard, which requires a 10 percent carbon intensity reduction by obligated parties by 2020, the computed number of gallons that will be needed to meet the diesel requirement, and again these are fungible between gas and diesel, but just focusing on the diesel requirement.

If you had a biodiesel or diesel alternative with a carbon intensity of less than 20, it would require about 540 million gallons a year of biodiesel. That would equal about a 12.6 percent blend.

And as Allen pointed out, you can use up to a 20 percent blend. And so we're well within what people call the blend wall.

So, B5 would be about 215 million gallons a year, B20 would be 855.

The current U.S. biodiesel production capacity is over 2 billion gallons a year, some estimates as high as 2.5 billion gallons a year.

The saying in the industry, of course, is that it's a three-legged stool. In order to have a successful biofuel you need feedstock, production and sales. And so feedstocks come first, you know, what are the feedstocks that are available? What's actually being utilized and what's the potential for feedstock?

Right now in-state used cooking oil, which has a carbon intensity of anywhere from 11.76 to 15.84, there's 100 to 150 million gallons a year available in-state, close to a billion gallons a year nationwide.

Animal fat is frequently mixed in with used cooking oil, so it's difficult to, on a statewide basis, get a separate number for that.

Out of state, throughout the U.S., there's about 800 million gallons a year.

Corn oil, which has a very, very low carbon intensity of 4, in-state there's approximately 5 million gallons a year being used. Out of state the EPA estimates that there's about 500 million gallons a year available.

As the California Biodiesel Alliance we looked at this and realized that there's a tremendous potential in the state to develop feedstocks in California, with low carbon intensity that benefit the entire value chain.

So, in areas like Central California, Western

Fresno County, where there's an unemployment rate of 24 to 40 percent, there's a lot of underutilized land, principally because of selenium contamination and saline contamination that can be used for growing feedstocks without displacing food crops.

And so we're showing on the right-hand side several of the projects that are currently underway. In the upper right-hand corner is Dr. Steven Kaffka, from UC Davis. He's the Director of the California Biomass Collaborative, which looks at feedstocks for both ethanol, and biodiesel, and renewable diesel.

He's there at one of the UC Davis field stations with one of the euphorbia's. That's the family of plants that include castor, and dutropha, and things like that. They have up to a 50 percent oil content.

The next picture down was taken about eight years ago. That's at Red Rock Ranch. And that's processing a brassica family, which includes canola, camelina, mustard, which grows on selenium-contaminated soil and provides bio-remediation. It's about 30 to 35 percent oil content.

And the agroeconomic work on that is still ongoing at UC Davis and Cal State Fresno.

The next picture is used cooking oil collection at UC Santa Barbara, my alma mater. We've been doing that for the last ten years.

And finally, the last picture is a picture of Dr. Steven Mayfield's project down at UC San Diego doing algae research. And they're closely affiliated with sapphire oil and other groups.

So, we have in California a tremendous academic and entrepreneurial base for feedstock development. And we feel that the potential is there, with the right incentives, to stimulate that in-state production of feedstocks, which then leads to in-state production of the biofuels, themselves.

Okay, so the next part is the survey. And like Tim said, it's a very easy question, and it was posed to us, it's been posed many times. How much biodiesel do you think can be produced in, and you fill in the blank, 2013, 2015, 2020?

And the answer to that, as we thought about it, really depends on your assumptions as to what the future is going to look like.

So, you know, what are the incentives, what is the economic condition, what's the price of diesel fuel, there's any numbers of factors.

So, we structured a survey, basically, to ask our members first of all, looking at a low scenario, a low projection, a middle projection and a high projection what do you think are the factors that are going to be most influential for you to make a projection about where the industry is going to be under that scenario?

And then we took those factors and compiled them together so that all the members could see everybody else's ideas, consolidated them because there was a lot of overlap, to make sure that we didn't damage anybody's concepts. We got buy-in from what the questions were, what the factors were and then had people or members rank each factor within a category.

So, in a low scenario there's maybe 20 different factors. We asked them to rank them from 1 being not very influential at all, to 10 being very influential for each category.

And then compiled all those numbers together, did a simple average and came up with a final number, and then ranked them from high to low.

And then divided them into 25 percent cohorts, basically so you could see the top 25 percent, the next 25 percent and on down.

Some of the bars look bigger. Like the first one in the low scenario looks like, well, there's, you know, more in that 25 percent, and that's just because it happened to cluster there. There were a lot of factors that were very similar and similarly ranked.

So, when you go across the categories you'll see, you know, what the different percentages were in terms of the most influential factors.

And I invite you to take your time, it's excellent night reading if you're having trouble falling asleep, to actually drill down into here.

I will give you a summary, though. We took each of the themes, so a factor, for instance, like no Low Carbon Fuel Standard. That would be a low scenario.

A medium scenario would be the Low Carbon Fuel Standard has been modified, or weakened, or is inconsistent.

And then a high scenario would be a strong, robust, consistent Low Carbon Fuel Standard.

Well, that concept cuts across all categories, low, medium and high. So, when you look at the categories and rank the scenario averages, this gives you an idea of what themes our members thought were most important in terms of stimulating production of biodiesel in California.

And it's difficult to say that there is a number one or a number two factor because they all cluster fairly closely together.

But you can see that feedstocks, different sorts of government incentives, the RFS, the RINs, the Low Carbon Fuel Standard, basic economic considerations of profitability, diesel prices, government market signals, plant funding for expansion, and growth of new facilities, de-bottlenecking old facilities, things like that can help increase the production of biodiesel.

So, after we had them rank the factors, we had them basically say, okay, based on your assumptions about what the future's going to look like what do you think the volumes of biodiesel will be in a low, medium and high scenario.

And again we took everybody's estimates, divided them by the number of responses, and came up with averages.

And you can see where in 2013 the projection for a low is 18.8, the projection for a high is 34.6.

And as you ramp up for the year 2020, if you have a low scenario, basically with weak and inconsistent signals, very little support from government, adverse market conditions, et cetera, there's still a growth in biodiesel production, but it's not very robust. It's about 43.1 million gallons is the projection at this point.

With the high -- and again, this is in-state. This is not the total amount of biodiesel that would be sold in California, this is just in-state production, it's about 362.5.

We foresee that there will be biodiesel imports into California, just like there's ethanol imports into California. There will be renewable diesel coming from Neste and other resources. But just focusing on in-state production there's an average of about 362.5.

Now, again, these are averages, not ceilings. So, you know, the potential ranked by some biodiesel producers was much higher, some lower.

But the takeaway here, I think, is that the factors for growth need to be very carefully considered and should be used to help inform policy.

You know, as an industry we're trying to answer the question of we're from the government, we're here to help you, and we're trying to tell you this is how you can help us.

These are the conditions on the ground as we see them as an industry overall, and these are the things that could be done to help stimulate biodiesel production in California using California taxpayer money to help benefit all the citizens of California.

The funding is needed for feedstocks and production facilities.

And then, finally, and this is strictly

editorial on my part, but in talking to Tim and Jim, basically how can -- how can CEC funding, the AB 118 funding be used to greatest effect?

And there have been some great projects funded, ours among them, involving research and development, and plant expansion, et cetera.

But, you know, when you're looking at $100 million a year divided into segments by many, many interests, it's not enough, you know, for any one of these interests to really expand. It can make a difference, but to make a significant difference we think that the type of funding available can be changed into different channels where the funding is used more for leveraging. Basically, being used to stimulate the use of loans through industrial development bonds, through the State Treasurer's Office, which are a tax-free bond, which are very attractive to investors, or through bonds.

But there are a lot of upfront costs that are involved in that. And so as the CEC creates projects that go from R&D to actual commercialization through the pipeline, when it emerges from the pipeline there should be something there to say, okay, now you're ready. You've been through this process and now we want you to prosper and expand. We're not going to give you money, but we're going to help you obtain a loan, we're going to help you obtain bonding.

And the leverage that can be achieved through that, with no exposure to the CEC, this is not a loan guarantee, is basically to say here's a million dollars that's available for all of the bonding expenses, the IRB expenses that are involved in obtaining $50 to $100 million dollars.

And so $20 million that's available can be leveraged pretty significantly over a period of years to create the kind of industry that we want in California.

COMMISSIONER MC ALLISTER: So, just if you could submit a description, sort of a schematic of how that might work? I mean, I think there are various folks who work with the other agencies and understand the bond markets, and sort of the financial transactions that would involve, but I think it would be good to put our collective heads around to see what a structure might look like.

It sounds like a very operable idea for the market -- sort of the mid-section of the market transformation to bring some real capital to it.

And then also any suggestions that you might have on the -- you know, the rounds of RFPs with AB 118 and, you know, I think they've gotten very robust, for the most part, responses, and I think there have been a nice diversity of projects there.

But, you know, obviously, we’re always open to hearing sort of how things could be targeted or tweaked, or how things need to evolve with the times and that sort of thing.

So, you know, given your understanding of kind of this diverse marketplace out there, you know, where sort of the various eggs go into which baskets would be helpful.

MR. TEALL: Staff has been very receptive. We’ve had a whole series of meetings over the past year. And the latest RFPs are reflecting some of our recommendations in terms of moving more from research and development to actual commercialization. You know, how many volumes of -- you know, how much volume can we increase it?

The next step would be to move to a different type of financing mechanism, and I’ll put that together. But that’s more than just for biodiesel, that’s something that could apply to all the baskets and make a $100 million-a-year investment, you know, factored by 50 or 100 times which would be, you know, very significant.

COMMISSIONER MC ALLISTER: Great, thank you.

MR. TEALL: Okay, I will take off my leather

Mexican wrestling hat and hand it over to Joe Gershen.

MR. GERSHEN: Okay, I wanted to also point out in what Russ had said about imports versus in-state production, I think the Bioenergy Action Plan also calls for 40 percent in-state production, if possible, of what's consumed in the state.

So, I just wanted to kind of point out the ARFVT Program requirement that the Commission use metrics to determine funding criteria, it's not just a good idea. We actually wanted to point out that it's the law, as well.

In Health and Safety Code 44272, and I'm going to read a few things here, 44272(c) is states that "The Commission shall provide preferences to those project that maximize the goal of the ARFVT Program based on the following criteria" --

And then it goes on to list 11 specific criteria including petroleum reduction and measurable transition of alternative fuels, climate change policy, and low carbon fuel standard, at least 10 percent lifecycle greenhouse gas reduction, air and water pollutants reduction, sustainability of state natural resources, promotion of California business in the jobs we're creating right now, as well as the use of existing or proposed fueling infrastructure.

It turns out biodiesel meets and exceeds all of those criteria and it really exceeds it quite spectacularly.

And then Health and Safety Code 44272.7(d), it states that "It is the intent of the legislature that the investment plan will provide an analytical rationale for all proposed expenditures that aligns with the broader strategic goals for the program and will update, highlight and explain the rationale for any year-over-year changes to the program strategy and priorities, and provide the legislature with all of the necessary information to fully understand how and why funds are to be allocated and prioritized within the program."

So, we'd like to know where are the metrics which would provide the analytical rationale?

Those of you who know me, know that I've been sort of beating that drum for a while now, but it's something that sort of continues to come up.

And then, also, if there will be no metrics in the 2013 IEPR, which I think there were supposed to be, but I'm hearing rumor that there may not be, I think we as an industry, we think we must at least use or continue to try to use the 2011 IEPR Benefits Report, which includes some metrics there.

In that report it states that biodiesel provides

34.7 percent of these benefits. And we actually think when these metrics are done it will show something much to the north of that.

And we think it should receive funding commensurate with this contribution rather than the 4.8 percent that we currently are receiving.

You know, if you look at those metrics, biodiesel is 9 to 20 times more cost effective than the other solutions.

So, kind of a simple investor question; where would you want to put your own money from an investment and a return on the --

COMMISSIONER MC ALLISTER: I'll push back on you a little bit here because I mean I totally see your point.

But, you know, you do have a lot -- if you think of it in sort of market transformation terms, not every technology or group of technologies is the same point along its particular market transformation curve. So, it does make sense that you'd have a diversity of sort of current cost effectiveness across those technologies, and that's not necessarily a bad thing.

But certainly, you know, to the extent that one or the other has limitations, and market barriers, and sort of opportunities and, you know, you've got to do an independent assessment, so I'm not entirely disagreeing with you. But I just think we need to keep the bigger picture in mind because --

MR. GERSHEN: We understand the concept of the transformative goals, although I think there should be some metrics applied to what those are going to be and how they're going to work.

But also, the disparity between 34.7 percent and 4.8 percent, we'd like to get a little closer to maybe the other side of that scale, that's all.

So, CBA has submitted an updated white paper, I think most of you know about this, to the docket for this workshop that goes into even more detail about this issue.

Last year Commissioner Carla Peterman asked staff to make this matter an urgent priority, but we've still not really seen any urgency, so we question that.

Metrics, and just sort of as a wrap-up statement here for my portion of this, metrics on the efficacy of past projects are supposed to be gathered to inform and guide future investments. Without them, the ARFVT Program is like a ship without a rudder.

Not to belabor this metaphor, but to not use what metrics we already have is like abandoning our wheelhouse altogether. That's sort of what we think is a good picture of it. Thanks.

MR. OLSON: Russ, did you have anything more or -- thanks very much.

COMMISSIONER MC ALLISTER: Thanks very much, that was interesting.

COMMISSIONER SCOTT: Let me just say that Commissioner McAllister beat me to both of the points that I also wanted to make. Which is in terms of the funding and the financing piece that you mentioned, it would be terrific to see more detail and information on that.

And, also, I'd just highlight the market transformation piece that we're also looking at in terms of what gets funded within the program. So, just wanted to highlight what you said.

COMMISSIONER MC ALLISTER: Sorry.

COMMISSIONER SCOTT: No worries.

MR. OLSON: Okay, to keep on schedule we're going to go to our next speaker, Tom Koehler of Pacific Ethanol.

I asked him if he could represent the three existing companies that have large corn ethanol plants and talk about -- and he's agreed to do that, the other companies have agreed to that.

And he's going to talk about the nature of how they are shifting to advanced biofuels. Tom Koehler.

MR. KOEHLER: Thank you. I appreciate the opportunity to speak today. My name's Tom Koehler and I'm representing the California Advanced Energy Coalition.

We're a coalition of a lot of groups. Today I'm going to focus on the four ethanol plants that are actually in California today.

So, starting from the south there's Calgren Renewables, which is a 60 million gallon plant operating today in Pixley.

There is the Madera -- the Pacific Ethanol Madera Facility, which is 40 million, which is not operating today.

There is Amadeus in Keyes, California, which is a 60 million gallon, which is operating today.

And there is a Pacific Ethanol plant in Stockton, which is also operating today.

So, combined capacity of operation today of 180 million gallons.

These plants are low carbon producers. They're all located in areas where unemployment is high. Roughly, each plant generates around 700 jobs per facility, economy-wide.

All the plants today have been using corn. And as we project out into the future, we'll continue to use some amount of corn because it just absolutely -- it makes sense. It integrates into the livestock economy of the area.

So, there is a -- and I'll pause there just to talk about when we're talking about biofuels, there is an Orwellian slogan called "food versus fuel" and it's Orwellian because it -- we need to do both and whether you're talking about biodiesel or ethanol, both those processes actually do both.

The facilities in California are the largest feed providers, the largest feed producer in the State of California are these facilities, to the livestock.

And in addition, if you look at the -- when, let's just say, 2005, when the ethanol national market took off and the amount of corn that was available for export and to the animals, and to other sources, other than ethanol, and you look at today when ethanol's gone this high and is using a significantly more portion of the corn, there's more corn today total, on the world market, for those other uses, other than ethanol than there was in 2005.

So, what has happened is that the increases in productivity, increases in demand have increased the supply. So, the world today is producing more fuel and more feed from the land base, and that's a good thing.

So, the food versus fuel, it's just a false argument, it's very Orwellian and I would like to raise that for the record.

We are -- oh, one other aspect of that, which I also want to put in the docket, which I'll provide a copy of, is the World Bank most recently released a report and talked about the impacts on food.

And the number one driver for the impacts of increased food prices is the price of oil.

So, any alternative that we use to displace oil is having a positive impact on the prices of food.

We are -- all the companies that I just listed are currently in the process of commercializing a variety of technologies.

The driver has been the LCFS, so making sure that that policy maintains a robust, consistent policy is a large driver for our investment decisions.

We are, as one of the ICF put up the slide, basically in California we're low carbon producers. We're about 80 CI. We have all submitted pathways to CARB, some in a variety of pathways between 60 and 77.

And we're doing that by projecting the use of sorghum, so switching from corn, and combining that with efficiencies in the plant, as well as the use of biogas.

So, we see in 2020, you know, with continued LCFS, with continued support from the Commission we'll have proposals to you in helping us commercialize this process of a significant amount of sorghum being used in 2020.

The other issue that I want to talk about, and this is very much in your wheelhouse, but it's also in CARB's, but it's in your wheelhouse to care about and advocate for, and it has to do with market barriers.

And, Commissioner, you talked about the capital market, you know, that the government's not going to provide the capital, and that's true to a large extent. But one role of government is to make sure that all barriers are removed and to have full access to the market, both from a consumer -- essentially have the consumers have full access to the market.

And right now we don't have that. Consumers don't have access to the market in terms of ethanol. I'm referring to the blend levels which are effectively capped at 10 percent.

Last year the EPA approved E15 for all cars from 2001 on, and forward. So that's a large chunk of the market.

And what really needs to happen in the most expeditious fashion to continue to send the right signals for investment is for the predictive model to be updated to where any levels up to E15, but it could be E11, or it could be E12, or it could be E13, depending on what the market dictates and depending upon what the consumer wants.

But today, and for the last three or four years, ethanol's been somewhere between 50 cents and a dollar cheaper than gasoline.

Well, the consumer needs to have access to that and it's a very simple process to make that happen. It's a bit time consuming so we ought to get started on it.

And I would put that as from an infrastructure stand point at a high priority item for the CEC.

So, those are my points and I'm happy to answer any questions.

COMMISSIONER MC ALLISTER: Thanks very much.

MR. KOEHLER: Okay, thank you.

COMMISSIONER MC ALLISTER: Let's keep it rolling along. We appreciate your being here, thanks.

MR. OLSON: Thank you, Tom.

And our last speaker this morning is Adam Walter, representing Propel Fuels. And by the way, we do have another speaker on biofuels right after lunchtime. And it's also some additional information on

Brazilian Sugarcane.

But at this point I'd like to introduce Adam to talk about some of the infrastructure topics related to biofuels.

MR. WALTER: Thank you, Tim, Commissioners, participants. Thank you to everyone for having us today. It's my pleasure to be here talking about these important issues for our State.

So, from Propel Fuels, for those of you who don't know I'll talk a little bit about who we are, what our mission is. I'll talk a little bit about the alternative fuel infrastructure that is installed to date, where we're going, and some of the challenges and opportunities that we face.

Propel Fuels is the leading renewable fuel retailer on the West Coast. So, we sell E85 and biodiesel, usually in a B20 blend, and we have stations in California and Washington.

Our mission is engage consumers in the transition to alternative fuels, create a leading network of alternative fuel filling stations, and build a leading clean fuel brand.

So, I thought I'd just share some pictures with you all of some of the recent construction that we've done in the State. This is a station we constructed in

March, in La Mirada, which is in the greater L.A. area.

You can see the tank hole here, the underground source tank being installed with a crane. That's a 14,000 gallon, three-compartment tank. I mean this is a pretty big construction project for a gas station here.

So, more pictures of this install. This is the tank in the ground and a very happy owner and operator when it's all said and done.

This is another station that we just recently opened, the first one in the Central Valley, in Fresno. And this is a full station. So, usually, you know, Propel's traditional model was we would partner with an existing gasoline station operator and install just one pump and a tank on their site.

What we've done recently is we're starting to acquire full stations, ourselves, and install underground storage tanks and operate the petroleum fuel, as well.

So, Fresno, this is what we call a Clean Mobility Center. And it really turned out well. I've got some more pictures of that later on.

This is an example of another clean fuel point. As I said, the more traditional model where we have a large canopy, which we're trying not to do as many of these anymore because they're very expensive.

And as you can see, this is sort of an example of some of the general conditions that a city will require you to do when they install something in their jurisdiction.

Locals refer to this one as the Taj Mahal, and another happy operator there and the happy customers.

So, we've got -- this is a recent station opening in Sylmar on the left, and the bottom right, with you can see some of the happy Hummer drivers filling up with flex fuel. And the Clean Cities Coalition logo on all of our pumps, as well as some of what we call tuners down on the bottom right.

With the Subaru's, a lot of these high performance engines guys like to tweak the computer chips in there to allow for the higher octane fuel, which is cheaper than race fuel.

And then the top right is our first customer at Fresno hugging the EVR Phase 2 nozzle that we have there.

So, where are we at currently? E85prices.com, 78 E85 stations in California; I don't believe all of those are public. I think the public number is closer to about 65 today.

And if you take the high side of what we do monthly, gallons throughput on some of our stations, that's approximately 30 million gallons per year of annual throughout capacity installed in the State today.

Currently, just taking E85, that's about .1 percent of the total ethanol demand in the State. Again, we have about a 1.5 billion gallon per year gasoline market.

E10 is, you know, ten percent of that, obviously Ethanol, E85, high level blends are only .1 percent at this time.

But we have over one million flex fuel vehicles in the State and we believe that that number is continuing to grow as there are many, many more flex fuel vehicles being sold in California and in the U.S. every year.

So, just a snapshot of some the locations in Southern California and Northern California, you can see they're mostly clustered in the higher population areas.

We always target our stations to be installed in zip codes with the highest flex fuel vehicle counts. So that's one of the traps that we run before we do any builds on any stations, we look for that criteria.

Propel just opened our 34th alternative fuel filling station in the State yesterday, actually at Wildomar. So, that's an E85 only station and we're partnered with the dealer there. We're doing a number of installations with them.

They operate a Chevron, currently, at a great location right off the freeway.

So, we have constructed about 12 stations in the last eight months. We also sell B20 at most of our stations.

And Propel has about three grants that we've -- well, yes, not about, we have three grants that we've been awarded in the last couple of years; the LCFI-3 grant, the Low Carbon Fuel Infrastructure Investment Initiative, which we're currently about 40 percent through with the Department of General Services, the Department of Energy and the California Energy Commission.

There is an LCFI-3-2 grant, which is for 10 stations that we will begin executing on sometime in 2014.

And then also the Clean Grant which is for another 100 stations, $10 million from the CEC, which we will start on after that.

So, what is the potential? You know, the CEC and DOE grants, as I said, have provided incentives for the first LCFI-3 grant, the 75 LCFI-3-2 is another 10, a hundred for clean, which takes it to 185 total for Propel. Plus, Pearson, I believe, has just received another award for about 15 stations.

So, to date we've received grants for 200 stations.

By the CEC's own modeling and analysis the market in California could handle up to 1,000 stations.

So, we would project that we would be able to finish with the 200 stations that we're currently operating on the agreement for by 2015. That's not just Propel, but Pearson as well.

And that would provide about 75 percent coverage. In terms of drive time, we talk a 12-minute drive time. It's good, you know, 75 percent coverage.

But by comparison, a typical gasoline driver can find a station in about a two-minute drive time. So, by no means should we rest on our laurels here and take this as a signal to not continue to fund these projects.

So, what are some of the challenges that we face? Permitting is, by and large, I think the largest challenge that we face.

Myself, I'm the Program Manager, I'm managing the architects and contractors throughout the permitting process, design build, engineering, and we face challenges at the State and the local level.

The State CUPAs, which is the Certified Unified Program Agency, part of the State Water Board, they operate at the local level and are basically, completely independent of the State. So, the State may try to influence them, but at the end of the day you're dealing with the local municipalities and whatever challenges they may have.

So, L.A. Department of Public Works, for example, is backed up four to six months in processing permit applications right now, which is just a killer for any projects that we're trying to move quickly.

The Air Quality Management District, as I mentioned in Fresno, we have an AVR Phase 2 nozzle there.

For some reason the San Joaquin Air Quality Control District has not adopted the executive order from, I believe it was 2009, exempting E85 from EVR Phase 2.

So, all of our other stations in the entire State have EVR Phase 1. And we, at this point, are not going to develop anymore in the Central Valley until they adopt that executive order, which they say they're going to do in December.

So, local, obviously we face challenges at the local level, as I mentioned, with the Taj Mahal and Claremont general conditions. When you go in and you apply for a new permit application they use that as an opportunity bring the rest of the site in compliance with whatever little things may be hanging out. So, we often have to come out of pocket for those expenses on behalf of the station, even though they're not related to the project.

And then conditional use permits, right, every gasoline station in the State of California operates under a conditional use permit. If you have to modify that conditional use permit, as we're having to do in Oceanside right now because we're changing the motor vehicle fuel that we're selling, that can be a very, very timely process. We're talking three to four months, if not longer, and very expensive as well.

Grant administration, you know, this can be a challenge just in the mechanics of payment. You know, for instance we have not received a payment from the DOE in, you know, quite some time on this program even though we've built a number of stations over the last nine months. And that's causing some consternation for ourselves internally, as well as our investors.

You know, the guys from CBA did a great job talking about how, you know, the markets really need consistent support in terms of capital availability and commitment over the long haul.

And I would like to say that the CEC has been a great partner and thank you all for doing all that you can to help move the process forward, and process payments quickly, so thanks for that.

And then equipment standards, you know, when you're bringing new fuels to market oftentimes regulations have not caught up with the development of these future fuels.

So, as we've seen with the water board, recently, and renewable diesel, well, at some racks in Fresno they're selling renewable diesel today. We don't believe that the regulations are clear enough today for Propel to take the risk to begin selling renewable diesel in our tanks until Underwriters Laboratories comes out with a judgment. Hopefully in the next few months, but there's really no time frame on that.

Otherwise, we're stuck lobbying our own manufacturers of components for signing a statement of affirmative compatibility with the water board and taking on that liability themselves which -- and often, in most cases they're not willing to do just because they don't understand the fuels, yet. So, some challenges we're facing there.

But also there's some opportunities, right. So, blend levels, as Tom mentioned, from Pacific Ethanol, you know, one of the biggest opportunities that we have right now is to be able to increase the blend level in the State of California from E10 to E15.

The blend wall is here today and it is a real thing for the ethanol industry, for the alternative fuel retailers.

Propel is installing the infrastructure today to be able to sell higher blends of renewable fuels, and today it's either E10 or it's E85, but there's nothing in between.

So, you know, if we were able to open the way to E20, or E30, or E50 the properties of that blend is actually better than any combination of just E10 or E85.

And like I said, the infrastructure is going in today so a change in policy would be the quickest and easiest way to increase ethanol blends in the State.

Renewable identification numbers, which are part of the Federal RFS, we've seen values rise to over a dollar per gallon in the last couple of months. This is an historic rise in the price and it's provided some much needed support to the bottom line for us retailers and blenders of the fuel.

The same with the LCFS, we've seen LCFS credits rise now to $60 a metric ton, which translates into real pennies per gallon. You know, I'm talking two or three depending on the blend of biodiesel that you're using.

But again, it's some much needed support for the industry at this time.

Carbon reductions, you know, to date Propel has collectively saved 77 million pounds of carbon dioxide from the atmosphere through -- this is directly from the consumers purchasing the fuels at our stations.

And we're also offering carbon offsets at our petroleum stations now, so for a dollar you can offset all the carbon directions of your -- or excuse me, carbon emissions of your purchase there. So, something cool and exciting we're doing there.

And then future fuels, which I'll talk about a little bit more in a second. You know, there's two platforms for advanced biofuels that we can leverage today, and both of which Propel isn't selling.

The flex fuel ethanol, as was mentioned a lot of the ethanol producers in the State are going to sorghum. We've seen the guys in the Central Valley doing sugar beets. Cellulosic ethanol is coming, and municipal solid waste. All of that can be leveraged with the existing infrastructure that we are installing currently.

And diesel, renewable diesel, as I mentioned it's being retailed today. There's more we can do to incentivize these fuels and the infrastructure to be installed to take advantage of those.

One of the examples that we did recently, in November of 2012, just last year, we did an event at our Redwood City station, on Whipple, with Solazyme, which is one of the leaders in the industry, and sold algae-based biodiesel to the public for the first time ever.

So, it was front page news on the *San Francisco Chronicle*, a lot of press coverage. We really had solid, you know, response from consumers, 35 percent volume increase throughout the Bay Area stations that were taking place with this pilot.

Ninety-two percent of participants noted that they would be more likely to purchase algae-derived fuels in the future. Seventy percent indicated they would purchase more fuel if it was derived from algae, and 40 percent said they would pay a premium.

So, I think a really great event and really happy with that pilot.

We're looking to do some more demonstrations to bring cellulosic ethanol directly to the public in the future, as well, as that becomes available.

So, closing thoughts, you know, we've seen really strong consumer demand volumes remain high, really higher than we've ever seen. The Fresno station is knocking the skin off the ball and if we could get through that DVR Phase 2 issue we would put another pump on that station because volume is just so strong.

So consumers, and I can't tell you enough, love the fuel, they love the stations. Everywhere we go they say build one here, build one here. You know, social media's presence is great. So, I can't say enough about our wonderful customer base and how excited they are about the fuels.

But, you know, despite the challenges, as I mentioned the industry is making solid progress. And as I've said, there's still some work to do and the Energy Commission's and other State agencies' continued support is very much needed and welcome.

So thank you for having me today and I'm happy to entertain any questions.

COMMISSIONER MC ALLISTER: Thanks very much. I really enjoyed by ribbon cutting at one of your stations down in the southlands, and definitely felt the love from the public who stopped by, and definitely the excitement around the station, itself. So, I think it was Fullerton, I believe, yeah.

But, yeah, thanks for all -- I mean, really, the hard work on the ground. I mean, you know, the barriers up and down the chain, you know, certainly we can help with some of those. But a lot of it is local and the permitting, as you referred to. I mean and that's not just in this sphere, but it's across the board in any sort of infrastructure you want to build.

So, definitely can appreciate all of those challenges and it takes a good, dedicated business that's got a value proposition and a business model that they think is really going to work to motivate the kind of creativity to get that stuff done.

So, you know, I'm feeling the challenges and really appreciate your work, so thanks for being here.

MR. WALTER: My pleasure.

COMMISSIONER MC ALLISTER: So, I believe we have some public comment now; is that right? Let's move on to public comment. We're just a few minutes behind here so --

MR. OLSON: Yeah, if you want to go to public comment, I know there's a couple -- Robert Bienenfeld, from Honda, has some comments.

If we don't have blue cards, but if you are interested, just raise your hand or come up to the dais up here, the lectern, yeah.

MR. BIENENFELD: Good morning Commissioner Scott and Commissioner McAllister.

I'm Robert Bienenfeld from American Honda Motor Company. I'm the Assistant Vice President of

Environment and Energy Strategy.

I appreciate the change to speak a little bit out of order. I think you're going to cover fuel cell vehicles this afternoon, but I have a schedule conflict.

Honda has a portfolio, what we call a portfolio approach to addressing the long-term goals of society, which has to do with reducing petroleum consumption and reducing the carbon emissions from our vehicles, as well as air quality, addressing air quality concerns.

So towards that end we have a very clean fleet, along with advanced technology vehicles, such as CNG, hybrid, plug-in hybrid, battery electric and fuel cell electric vehicle technology. And we've had many of those vehicles on the road for years.

California's goals are challenging. I think there's no question that it is enormously difficult to make this transition to any fuel other than the liquid fuels that the -- that society's been accustomed to.

And the success of that transition is not at all clear.

So, we're very enthusiastic about the future of fuel cell electric vehicles. They're one of the few near zero emission or zero emission vehicles that have the chance to fully replace an ICE due to their features, the kind of applications they can operate in are broad. And they have the similar attributes of conventional vehicles, they can refuel in five minutes and have a range of 300 miles.

Honda's had the FCX Clarity on the road in California since 2008. We had a prototype version before that, beginning in 2002. And we've been getting really good information from the market on real-world performance, not just of our vehicles, but of consumer habits, of the requirements for infrastructure, where the infrastructure needs to be.

And we've had a very good relationship with the Energy Commission. We've been able to feed back that valuable information into the kinds of PONs that you've offered in order to get the infrastructure out.

As we look towards the future, Honda has announced plans to bring a next generation fuel cell vehicle to market in calendar year 2015. And that will be of significantly larger scale than the FCX Clarity. And it is obviously contingent upon the availability of infrastructure.

We're very pleased with the efforts that have been made, especially of late, with respect to infrastructure in California.

We have been supportive, both directly and through our trade associations, of the funding which is currently being proposed in AB 8 and SB 11 to fund up to 100 stations.

We think that the roadmap that has been published by the California Fuel Cell Partnership is -- reflects all the input of the major OEMs that are coming to market with fuel cell vehicles. It's comprehensive, it's very thoughtful.

And in our analysis, we have determined that the 68 stations really does represent the emerging market.

So, if you look at where those stations are relative to hybrid owners, or battery electric vehicle owners, those stations are in the right markets, where the psychographic and demographic attitudes of people are consistent with an approach to be open to these advanced new technologies.

And then towards the long term, Honda recently announced a partnership with General Motors to collaborate on a 2020 fuel cell power plant and hydrogen storage, a common set of drawings that could be used for both companies. In this way we hope to drive down the cost and really accelerate commercialization.

We'd like to thank the CEC for their continued support and investment in hydrogen infrastructure and I'm happy to answer any questions for you.

COMMISSIONER MC ALLISTER: Well, thanks for being here. I got to drive one the other day when we had some out front, so thanks for that. And, you know, I think rather than -- it's interesting to just keep in touch with how you see the marketplace going and sort of where things seem to be evolving.

I mean, obviously, it's a very attractive technology for the reasons you mentioned. Again, you know, it's the challenge of sort of helping -- you know, having the right policies to get the marketplace going and, you know, industry's obviously got the most central role in making that -- sort of getting the product to the level where it can really go massive and exist, you know, on its own merits.

You know, but we're all kind of aiming in the same direction, so I really appreciate you being here and hearing your comments.

MR. BIENENFELD: Okay, thank you.

MR. MUI: Good morning -- oh, I should probably say good afternoon, Commissioners. Thank you for the opportunity to give some public testimony today.

I'm Simon Mui with the Natural Resources Defense Council.

Thank you, everyone, actually for bringing together really a diverse group of stakeholders on today's agenda. I agree that this could take literally three days to go through a lot of these really information-rich presentations.

You know, I'll keep my comments limited to the biofuels discussion. You know, NRDC very much sees a lot of these different fuels, not just hydrogen, electricity and advanced biofuels playing a key role here.

We don't see the ability to meet our longer term GHG reduction goals really without a direct liquid fuel replacement.

And that's why we've focused so much time and effort in terms of things like the Low Carbon Fuel Standard, but also AB 32 and the State's plan, together with AB 118.

One of the areas that I just want to encourage that I heard a little bit about was around this question about feedstocks, and taking -- having CEC take a look at the feedstock equation.

Because, essentially, a lot of the energy sources for biofuels will be determined in part by the availability and supply of low carbon feedstocks.

And in our past work we've spent a lot of time looking at certification programs, like the Roundtable and Sustainable Biomaterials, to help provide both assurances, as well as encouragement for certain types of feedstocks that are identified as sustainable.

And, you know, I see Mike Wall here from ARB, they also have a Sustainability Working Group looking at the Low Carbon Fuel Standard, looking at ways to incentivize those types of feedstocks.

And I think one of the areas that CEC could have also a bigger role in is helping provide sort of either incentives or a forum to have those specific types of feedstocks encouraged and certified, so that there are assurances going forward that we are developing the best sorts of biofuels, the lowest carbon. But also ones that can help reduce things like fertilizer use, water usage, all the practices that are consistent with a longer term goal of replacing a large pool of liquid fuels.

And I just want to close off by just commenting on a little bit around metrics, because that seemed to come up quite a bit during today's discussion.

But really, you know, metrics around AB 118, but also around looking, as you go forward, around the transportation forecast.

You know, I think the metrics in the reports right now primarily focus around, you know, here are the volume penetrations and costs. But I'd encourage looking at, also, because part of the goals around the

Energy Commission are about diversifying the energy sources, looking at metrics around, you know, the value of diversification, you know, expanding the energy supplies in California, as well as the GHG emission reductions from the different types of scenarios, as well as the individual fuels would be a good way to look at it.

And one area that is particularly valuable is to have a better understanding of the benefits in terms of energy security, but also in terms of the reduced -- having a greater amount of fuel suppliers in the marketplace in California, and what impacts those have in terms of prices, in terms of costs, that diversification particularly given California's large fuel consumption would be a helpful area for the IEPR to go forward looking at.

And I will just close off that, you know, I think going forward everyone seemed to be supporting CEC's efforts around AB 118 and it's more a question about dividing up the pie.

But I would also looking forward, you know, three, four, five years out, even a decade out, I think to the extent we can have this meshing of conversations and metrics around AB 118 investments, as well as the GHG investment plan being developed by the sister agency, ARB, I think will go a long way to making sure the pie is -- the slices are not just divided up right, but also large enough.

And I think that's one of the challenges CEC has had in terms of the AB 118 process is that all of these technologies are in different stages, there's near term and longer term sort of considerations.

And to the extent we can look at a variety of metrics, I think that is a helpful way, but not to forget that there's also other pots going forward that it would be great to have coordination between CEC, and ARB, and other pools going forward.

So thank you.

COMMISSIONER MC ALLISTER: Thanks very much for your comments, totally agree.

And I mean I think that to the extent that this conversation is broader than just the agencies, you know, the bigger ecosystem includes NRDC and others I think is really helpful to frame the discussions for all of us, you know, in terms of sort of what's at stake and what's needed.

And then, also, just keeping us all focused on the right things in the conversation.

So, if the need is to grow that pie, you know, it's got to be well-justified and it's got to be, you know, enough of the stakeholders on board to make that happen, you know, to reach our -- what are essentially common policy goals.

So, a lot of it is information and working together to kind of have the conversations steer in a productive direction. And, I mean that obviously rests with the agencies, finally, but it is a broader conversation than just that, so really appreciate your contribution to that.

MR. OLSON: Okay, any other questions in the room here?

I don't think we have any questions online or on the phone.

COMMISSIONER MC ALLISTER: Okay, so --

MR. OLSON: So, Commissioners, your preference for --

COMMISSIONER MC ALLISTER: What was that? I didn't quite follow that?

MR. OLSON: Your preference on what to do next?

COMMISSIONER MC ALLISTER: Oh, well, are we -- we're basically going to -- we're at lunchtime. We're only about 10 minutes past the agenda, so I'd count that as success for sure.

MS. KOROSEC: Absolutely, for an IEPR workshop, yeah.

COMMISSIONER MC ALLISTER: Yeah, exactly. But thanks again. I neglected to thank the staff on the IEPR, Suzanne and her team, and Lynette, et cetera. I mean you guys just always do such a good job of keeping it tight, but also substantive. So, I want to just commend you again.

And I am going to actually step out. I have a plane to go catch. But Commissioner Scott and Hazel Miranda, from my staff, is going to sit up here on the dais representing me in the afternoon.

So, I really thank you all for coming and look forward to seeing what happens in the afternoon, when I get back.

MS. KOROSEC: We will take a one-hour lunch. We will reconvene at 1:15.

(Off the record for the lunch break at 12:13 p.m.)

(Reconvene at 1:18 p.m.)

MR. OLSON: So, Commissioner are you ready to start?

So, we're going to continue our workshop. The next two speakers are going to be participating by WebEx. And a little carryover from the morning, we're still on a biofuel topic.

And our speaker who will join us now is Joel

Velasco. He's works for a company called Ameris, but also an officer or an advisor to the UNICA, which is the major Brazilian sugarcane association. I think it represents close to 60, 65 percent of sugarcane ethanol producers in Brazil, and adding some additional comments on sugarcane ethanol.

So, Joel are you online there?

MR. VELASCO: Yes, I am.

MR. OLSON: Go ahead and proceed.

MR. VELASCO: And just to be clear, I think you guys have a presentation there that you're following?

MS. GREEN: Are you going to control the slides, Joel?

MR. VELASCO: No, you can control it. Sorry, I'm actually not even sure how do I control it.

MS. GREEN: Oh, okay. Hold on for a second.

MR. VELASCO: I guess while we -- there we go, we're getting the slides, at least I'm seeing them.

So, just by way of introduction, apologies for not being there in person, I'm actually just nearby in Emeryville, California today. But I was unable to get out to Sacramento in time for the meeting.

I'm a Senior Vice President at Ameris, which is the renewable fuels and chemicals company based here in the Bay Area, but with extensive business focused in

Brazil.

As some of you may know, I represented, as the chief representative of the sugarcane industry association, UNICA, for several years and was pretty active in the original LCFS work, and still follow this very closely.

And I retain as an advisor on the board of UNICA down in Brazil. That's where I'm originally from.

There in the room you should have Letitia Phillips (phonetic), a good friend and the current representative of UNICA in the United States. And she obviously can provide and answer some questions you may have.

If you can move to the next slide, let me just jump right into it.

You had a presentation earlier today from Plinio Nastari, also a dear friend from Brazil, and you've probably gotten probably the best guy in terms of sugarcane in the world, or certainly for Brazil to speak to you.

But the reason sugarcane and Brazil are tied together is because Brazil's number one in that business. I can say this is Ameris, but also UNICA, is sugarcane, we believe is the most photosynthetic efficient crop available in large scale today, and

Brazil is the world's largest producer of that crop, twice that of India.

Most of the cane grown in Brazil is actually concentrated in the south central region of the country, which also happens to be the most populous area.

It's almost as if California had Iowa's soil and were trying to produce crops. In other words, Sao Paulo has the population center and the economy, and also the great land for producing sugarcane.

And one of the great things about Brazilian sugarcane, I think that really makes them distinct is that they've been growing -- their yields have been increasing at about 3 percent on an annual basis since the late 1970s.

They have a lot more to go and I'll touch on that. I think that sense there's some great lessons that can be taught from U.S. agriculture, but Brazil has come a long way in this crop.

The next slide, please. Sugarcane plays a huge role in the Brazilian electricity matrix and Brazil is heavily dependent on renewable energy for its electricity. Hydro is primarily the source for electricity generation.

But the actual number one source of renewable energy in Brazil today remains sugarcane, both because of the biofuel, but also because of the cogeneration of electricity at the plants in Brazil.

So, it's really, as you see there, a pretty diverse energy matrix in Brazil, but with a significant renewable content.

The next slide, please. To just give you a sense of the industry, as I think was noted earlier we have -- UNICA represents about 130 producers and mills, and they're responsible for roughly 60 percent of all the production in Brazil.

And the large, primarily everybody that's exporting, I would say, is an UNICA member.

This year in the industry we estimate Brazil will produce about close to 600 million metric tons of raw sugarcane, of which will be processed into about 38 million tons of raw sugar. That is basically half of the world trade in sugar. Brazil is the world's largest supplier of sugar.

And then they will also produce about 6 billion gallons of ethanol, which is now less, probably about 40 percent of what U.S. production is, and about 800 million gallons or so that ethanol will be for the export market is probably the estimate.

And as I mentioned earlier, there's a lot of electricity produced from these mills. These mills are all self-sufficient electricity.

The next slide, please. Much of the discussion around sugarcane and Brazil, there's always sort of this interest of where is it and what about that Amazon, and all those beautiful ecosystems Brazil has.

I think the key point here to make in this slide, as you've probably seen before and as CARB realizes, sugarcane occupies about 1 percent of -- 1 to 1 and a half percent of total land, and we're producing about 600 million tons per crop here right now.

That works out to either, depending on how you do the math, about half of Brazil's territory, or 2 or 3 percent of Brazil's arable land.

And I think one of the fascinating things is the ability, not just as this crop, but really is the diverse nature of Brazil's agriculture. People sort of lose sight of it and when you're talking biofuels, they think it's all about sugarcane. But Brazil's largest crop today is and will remain soybean. Basically, number one producer, sharing that spotlight with the United States.

The second crop tends to be corn. Last year Brazil exported more corn even than the United States, largely because of the shortage in the U.S. crop.

And Brazil has a lot of cattle. In fact, Brazil has more cattle than people. There's about 200 plus million head of cattle.

The next slide, please. One of the -- and I know there was a little bit of a discussion about this, I think in the morning, I was told, but there's always a lot of concerns about the sustainability of the expansion of sugarcane.

So, people accept that while sugarcane's a good crop, you can get good biofuels out of it, but can there be growth and can that growth be sustainable?

One of the things I was pretty proud of participating in during my full time tenure at UNICA, several years ago, was the slide you're seeing which is the agroecological zoning in Brazil.

The industry went to the Brazilian government and said tell us, let's figure out where we could expand the sugarcane growing areas and where would be go and no-go areas.

And through this process what basically the government did, and what we worked out with them, was identified areas that were appropriate for expansion and were not.

And the government then did two things. One is we made those public and people can use that as sort of part of their investment decision but, more importantly, the government uses this in all of its licensing processes. All of the banks use this for loaning.

And the beauty of it that comes out is basically there's about 665 million hectares, or about 160 million acres available for expansion in Brazil which, by the way is roughly 7 percent of Brazil's land mass.

When we think about that and the industry today occupies one-eighth of that area, so there's quite a bit of potential growth for the industry.

The next slide, please. And this is a slide that's dear to me, as Ameris as well, because the industry has been producing sugar and ethanol for many years. We used to drink most of our ethanol before we started putting in the cars in Brazil, and then electricity, as I mentioned.

But there's a number of other products. Because basically anything, all these carbohydrates that are produced, all these sugars can be converted through the beauty of some of the great technology we're developing right here in California into plastics and hydrocarbons, and so forth.

And as Ameris, I'm proud to say we have over 300 buses in Brazil, in Sao Paulo and Rio running on renewable diesel.

California technology produces Brazilian sugar and we hope over the coming years we'll be able to expand that production and maybe even some here in the United States.

The next slide, please. So the industry is very diverse and it's got all these great potentials, but we also have some of what I would say are big challenges ahead of us.

There have been really two major changes over the last few years that affect sort of the outlook for the industry.

One is we went through a boom, just like in the U.S. industry in ethanol, and a boom in construction. That construction boom came to an end and there was a lot of consolidation in terms of M&A activity.

And then we're now -- and we also are going through a phase of really optimizing production and sales, and sound logistics, and things of that sort.

The next slide, please. The boom can be mostly evidenced on that new -- you can just click through. I think there's a couple automations there. Go back, sorry.

The numbers of mills that were coming online peaked in 2008 and really where we stand now is basically flat. There's basically no new production coming in.

The next slide, please. And the -- what we've also seen during this process is an increase in mechanization. Sugarcane, historically, for hundreds of years was harvested manually. But thanks to a lot of technology developments we've been able to improve -- we've been able to actually now put machines to work there.

This has had a great benefit because not only can you produce more, but you actually improve the skills of workers and, of course for the local economy there's great growth in terms of products sold and things like that.

The next slide, please. And during that same period we've seen considerable improvement, not just in the mechanized harvest, but also the planting. Planting used to be manual.

And what you've seen, these lines basically showing you there is that we basically -- as we hit the crisis in 2008, 2009 everybody stopped renewing their crops, basically, not working the soil. And that resulted in a significant loss of yield.

But over the last two years there's been an uptick on that. And so, in 2012 alone $4 billion have been invested in improving the soil.

And we expect that that, coupled with the machinery for our harvesting is really -- even though the industry is not growing in the number of mills, the volumes and the opportunities for additional production will go up.

The next slide, please. And you can click through that, thank you.

And another area that's really, I think, very important, that's been something very common here in the United States in terms of logistics, and in Brazil, really, where most are the costs are associated is that we've been -- most of the transportation, and as CARB knows well from their lifecycle analysis, the transport has been always by truck.

By making a lot of these investments over the last couple years, we now have a pipeline and waterway transportation for ethanol into some of the main centers.

This is a significant investment, about three and a half billion dollars over these last three years, and going through 2017. But much more importantly they're going to reduce cost and reduction of cost, especially in the fuels markets, that's going to serve consumers no matter where they are.

The next slide, please. Now, let me turn -- so I gave you a little bit of a review of where we've been.

Now, let me talk a little bit about some export production.

You can move to the next slide. So, back in 2010, if you saw me present at some place, you might have seen this slide. And back then we had a crop of about 600 million tons, 602 to be exact, and we produced about 32, 33 billion tons of sugar. Most of that got exported.

And then, you know, 6.8 billion gallons of ethanol, of which about 800 million were exported and, of course, quite a bit of electricity, too.

And then as we looked forward to 2020 at that point, the view was that that industry will grow to about a billion tons of cane. They would grow a bit, the sugar market, but the world sugar market is basically growing about 1, 2 percent a year.

And the ethanol biofuel market would grow considerably, and particularly on the export side, but also on the domestic.

As I pointed out, we had a bit of a financial crisis in between. A number of things changed. Presidents in Brazil went, and we got a new president with a different approach to energy policy in the current government.

And as a result, those projections, then many people questioned whether they're still feasible.

The next slide, please. When you look at this period, and that's really what this chart is showing you, the increase in tonnage of sugarcane went from basically 300 million tons all the way to roughly 600, and stalled over the 2008-2012 period.

And we expect that this area of the country will produce upwards of 600 million tons. And the reality is the capacity of the industry is right there around 700 million tons or so of raw cane.

I think you need to do a click on that slide. If you look from the export side, the best year that Brazil had in terms of exports was in 2008, roughly 1.3 billion gallons. About half of that, in general, goes to the United States.

This year we estimate, as EPA I think as come to a pretty close number, that Brazil exports somewhere around 800 million gallons of ethanol and, in this case this year, probably I would venture to say half to two-thirds of it may well go to the United States.

And now this year, I think we already see from the trade data that Brazil has not only just -- you know, the first half of the year, which is usually the quiet part of the year, Brazil had already shipped upwards of 200 million gallons to the United States.

And the trend to be that at least a quarter of that ethanol is coming into California either via the Port of Houston, and then trained into Southern California or, actually, directly by ship with, obviously, the ship making the crossing in the Panama Canal.

The next slide, please. So, it's important as you think of projection as to try to understand what is really driving cane ethanol demand. Where is the demand coming from?

And until now, and probably for the next couple of years, demand is really -- in cane ethanol is really driven solely by domestic demand, primarily the flex fuel vehicles.

Brazil, half of their light vehicle fleet is flex fuel, meaning that it can consume either pure ethanol in the case of Brazil, or a gasoline, which in the case of Brazil is at 20 to 25 percent ethanol.

And these consumers in these flex fuel cars in Brazil have learned, and there's even an app for that, I can share it with you, that they should only buy ethanol if the price is no more than 70 percent than the price of gasoline.

In 2009, for example, nearly all flex fuel vehicles consumed only ethanol, but it's considerably less today.

Why? Because the government has had a policy to maintain gasoline prices flat for basically for the last seven years, largely to control the inflation. The Brazilian government has the benefit of also owning the oil company, so they've opted to subsidize gasoline by importing more expensive gasoline and selling it at roughly a loss of 50 cents per gallon in the domestic market because they're trying to control inflation.

The result of that though, however, as we pointed out, is discretion, you know, let people -- if somebody wants to sell cheap gasoline, even an ethanol guy is going to say, well, you might as well just buy it.

Unfortunately, that discretion has made the financial crisis of 2008 have an even bigger impact in this industry. And that is really what's the challenge we see in Brazil driving demand.

You had a financial crisis, you have a government who's sort of subsidizing petroleum products to the tune of right now 50 cents per gallon is sort of our calculation, and that has really stifled the growth.

However, as you look forward, even without sort of a change in government policy, mind you I do think the government is going to change, they're starting to see the writing on the wall, the industry will need to grow to meet demand at home and abroad.

And this is why I said until now flex fuel cars and domestic demand has been driving it, but other policy signals and other market signals are starting to change this.

The next slide, please. So, what we know for this year's production is Brazil will produce about close to 600 million tons of cane and about 35 or so million tons of sugar. Most of it will be exported. And they'll produce, let's call it 6 and a half billion gallons of ethanol, and about 700, 800 million gallons will be exported.

As I said earlier, about half of that is coming into the United States and about a quarter, at least year to date, roughly, has been coming in to California.

I would expect in the very short term that that would be the trend. But as we go out to the out years, into 2020, knowing that the industry is growing, has grown in the past, it's quite reasonable that it will grow.

And I think here I will say one of the biggest challenges is ethanol today has always been sold and continues to be sold in the spot market. There's really no, at least for Brazilian products, much of a long-term contracting market.

And the uncertainty on policies in the United States, for instance, RFS, and LCFS, coupled with, in the case of California, I think and unreasonably high carbon intensity number has really put a cloud over the outlook for imports from Brazil, or exports from Brazil into the United States. Nobody's really contracting for this.

And until there's going to be a lot of contracts or commitment to contracts you're not going to see increase in production.

And so we're sort of at this Catch 22 of having a policy that you know as the LCFS, as we're going to need low carbon fuels, but those low carbon fuels aren't being produced at the quantities necessary because nobody's quite sure that the policy's going to be there.

And I think that is one of the areas I think I would encourage the Commission to look at.

I've been saying this for some time, but the quicker CARB reduces the carbon intensity of ethanol, as have other regulators around the world have come to that conclusion, the more certainty that they will give to the marketplace that the credits that they are buying are, indeed, reasonable going forward.

And then finally, I think by doing that you're going to be incentivizing the investments in terms of logistics in the United States, primarily in California, whether they're going to be in storage in Southern California, in the ports and so forth, and helping make that adjustment.

And candidly, from a company, from an Ameris perspective, our technology will depend and our investments will depend largely on the growth of the cane industry there. So, our ability to continue innovating and bringing some of our great technologies, whether it's produce renewable diesel, or jet fuel, or some other product will depend on a strong sure gain industry, which is why I have this sort of perverse interest of seeing the industry there continue to grow, even though we're here in California.

I will go through the remaining slides very briefly because I want to -- I think I'm probably mindful of my time.

So, if you go one more, please. Just to remind you guys, actually, you guys know this, cane ethanol is -- meets an advanced pool and, you know, through the end of the 2020 cycle there's at least about 4 billion gallons of that that would be necessary.

Please, the next slide. And we've pointed out to CARB that to use their methodology -- to EPA, to use their methodology they should have a reduction of about 73 percent. And then EPA came out and came pretty close to that, I would argue, at 61 percent reduction. So, definitely sounded very good reduction, as we think it was reasonable to make.

The next slide, please. And this is what they came up with.

The next slide, please. As we look at California, the next slide, we have -- this is the point I was making on the iLUC penalty for the -- the carbon intensity penalty for the indirect land use is about 46 grams of CO2 per megajoule. And that's disproportionately high. We've shown to CARB that should be probably as low as in the single digits. And we would encourage CARB to revisit those numbers sooner, rather than later.

Why, the next slide, is that without that -- I'm sorry, one more. Without that change, even using the exaggerated iLUC numbers, we know that blending ethanol with gasoline in California can help you be compliant, say 2015 at some point, 2016, maybe. But at some point it becomes impossible.

And since we probably know that these higher blends that are going to be very difficult in California, the uncertainty that is created by this exaggerated iLUC factor number makes it -- you know, who wants to invest in a plant that you're only going to be selling for a year or two?

Who wants to invest in a tankage storage when you're going to be able to buy a product that's only going to be stored for a year or so.

So, as CARB reviews those numbers, using the best science available, we believe that those numbers will come down and the outlook for sugar cane ethanol imports will improve, and I think that you will see the investments flow, whether they're in the U.S. or in Brazil.

I don't think there's another slide, but you may want to check on that. Yep, that's it.

I'm happy to take any questions. I do think, just in terms of summarizing, I do believe the projections we made back in 2010 are still reasonable. I think if you look, that Brazil could be exporting upwards of 4 billion gallons of ethanol by 2022 to the world.

I do think it is reasonable to expect that Brazil could be exporting about half of that to the United States.

And I think it is reasonable to expect that as much as maybe half of that could be coming into

California during -- by that period.

I think the big question is will the demand really be there? In other words, will the policy be there and will we be applying the best science that is available to this.

I'm happy to take any questions. And, again, I apologize for not being there. Letitia, who's in the room, can also handle some of the questions, as well.

COMMISSIONER SCOTT: This is Commissioner Scott. Thank you so much, Joel, for your terrific presentation. You actually -- as questions popped into mind, as you continued talking you would answer them. So, I do not have any questions.

I wanted to note that we have been joined by Hazel Miranda, who is Commissioner McAllister's advisor. And do you have any questions?

Okay, no, we're good. Thank you for the great presentation and taking time to call in from the road.

MR. VELASCO: Yeah, well, come visit our labs. There's some really great technology and we're trying to tackle some of the same challenges I know the Commission is looking at.

MR. OLSON: Very good, thank you, Joel.

And now we're going to go on to our next session, which is electric transportation and hydrogen technology.

And our first speaker is also going to be presenting remotely. His name is David Greene. He's a principal at the Oakridge National Lab. And he's going to present some information on his study of analyzing the transition to electric transportation, some U.S. wide and then also California-specific.

So, David, are you online there?

MR. GREENE: Yes, I am. Can you see the slides?

MR. OLSON: Yes, we can.

MR. GREENE: Okay, very good.

MR. OLSON: Wait a minute, we've got the wrong item here.

MS. KOROSEC: David, you need to pull up the slides on your machine. You have the control of the presenting rights.

MR. GREENE: Okay. Well, I see them on my screen so there must be some reason why you're not seeing them.

MS. KOROSEC: Did you click on share desktop before you pulled up your slides?

MR. GREENE: No.

MS. KOROSEC: There we go.

MR. GREENE: Okay, how's this?

MS. KOROSEC: Yes, they're coming through.

They're coming in now.

MR. GREENE: Okay, very good. Thank you.

Well, it's a pleasure to be able to talk to you about this today. I wish I could be in California, myself, it's raining here in East Tennessee.

But I'm going to talk about the study that my colleagues and I, at the University of Tennessee's Howard Baker Center for Public Policy did for the International Council on Clean Transportation.

But as you can see from the slide here, behind our study is the NRC study on Transitions to Alternative Vehicles and Fuels.

And the reason for that is that we used precisely the same model used in the Transition Study, and the same assumptions about technology and behavior as they used, and the same base case assumptions about energy, and vehicle sales, and so on.

So that we're starting with essentially their model and assumptions; I was a member of that committee so this was easy to do.

But I think this is useful and good in that it gives people a well-documented and I think unbiased basis for the study that we did on the Transition to Electric Drive in California.

So, the purpose of our study was to try and measure the cost and benefits of this transition and to work towards what we call a new economic paradigm for energy transitions.

It’s more than just internalizing externalities; it’s making a large scale energy transition.

And questions like: How much is it going to cost? How big are the benefits? How long will it take? What role will policies like ZEV mandates play? How important is the infrastructure? How about the policies outside of California and the Section 177 states, and how do we understand the fairly profound uncertainty that faces any policy looking towards 2050 and beyond?

As I said, we used the NRC’s model and studies that’s well documented, and the documentation and such is all available online from the National Academies.

The key premise of this study was that the country continues to require efficiency improvements to light duty vehicles.

Our study, like the NRC study, addressed only light duty vehicles.

And you could see here that although some people have said the new CAFE standards are required, unprecedented fuel rates of efficiency improvement, actually the rates during the 70s and early 80s were a little faster. But still, these are quite challenging.

And our projections used in the NRC study are very consistent with meeting the 2017 standards and meeting the 2025 standards.

You see on this graph the fuel consumption metric, gallons per hundred miles on the left side and fuel economy, which is therefore nonlinear, on the right-hand side.

The next slide shows, in sort of familiar fuel economy space, what those projections mean for different kinds of technologies, battery electric vehicles, fuel cell vehicles, hybrid electric vehicles, and plug-in hybrid electric vehicles for passenger cars and light trucks.

I say plug-in hybrid electric vehicles, but they have the same energy efficiency as hybrid electric vehicles operating in a charge sustaining mode, and they have the same efficiency as battery electric vehicles when operating in charge depleting mode. That's the assumption of the NRC study.

This graph is hard to read, but I put it here for reference. The basic idea is that a key component of the change that is brought about by the tighter fuel economy and emissions standards is a reduction in the power requirements of vehicles.

Here, the power reduction is about one-third, from 118 kilowatts to 78 kilowatts in 2050, achieved by a combination of a 30 percent reduction in the mass of the vehicle and similar reductions in rolling resistance, and aerodynamic drag.

That's important because the costs of battery electric vehicles and fuel cell electric vehicles scale much more directly with the power requirements.

And I think the NRC study is the first one to show how that could result in battery electric vehicles and fuel cell electric vehicles eventually becoming cheaper than internal combustion engine vehicles, whose power train costs, because of the complexity of the moving parts, and the accessories required, and the after treatment required eventually become a little bit more expensive than battery electric and fuel cell electric vehicles. The costs don't scale quite as well with the power requirements.

So, I think this is a very important finding of that NRC study. It's thoroughly documented in the appendices to the study, which as I said are available online.

This is for passenger cars. For light trucks it's a similar situation. But because the weight reductions and the other power load reductions are not as great, the internal combustion engine remains the cheapest option, even in the long run.

So, that's a background on the costs.

The NRC study also includes de-carbonization of all types of energy, whether it's electricity, or hydrogen, or gasoline. And this shows the assumptions about biofuels.

Not ethanol, which we just learned about, but thermo chemically produced through pyrolysis, drop-in biofuel that's chemically equivalent to gasoline.

And they estimate that it will eventually cost $3 to $4 per gallon. That's more than gasoline, but not much more in the projections they use from the annual energy outlook.

And the amounts they estimated, there would be a maximum amount of about 45 billion gallons available.

Fortunately, in scenarios in which there's a substantial amount of electrification, you don't need anywhere near that much biofuels, and you'll see that later.

A brief description of the Lave-Trans Model, first of all it's named after the late Charles Lave, who was an economist at University of California, at Irvine, a transportation economist.

And he and Ken Trane, at UC Berkeley, were the first to apply discrete choice models to analyze automobile choice. And so this light duty alternative vehicle energy transition model is named after Charlie Lave.

But those of you who are familiar with these kinds of model will see down the middle the usual vehicle sales, stock turnover as the sales are added and older vehicles are scrapped. Vehicle use estimation, which includes rebound effect. And energy use, then greenhouse gas emissions.

What's different about this model, one thing is it includes vehicle choice, which also includes the effects of things like the willingness of innovators and early adopters to pay more for advanced technology vehicles. The risk aversion of the majority who would need a discount to pay for -- to be willing to buy advanced technology vehicles, the effective fuel availability on vehicle choice, the effective diversity in make and model choice, and so on.

These kinds of transition factors are quantified and can be monetized in the vehicle utility and choice model.

The other factor is the lines you see in red, which are the positive feedback loops, basically, and these turn out to be quite important.

Increasing vehicle sales produces scale

economies, produces learning by doing, reduces the risk aversion of the majority as more and more vehicles are sold, and they see that the vehicles work. Energy use needs to more profitable infrastructure and also, therefore, greater fuel availability.

And these kinds of positive feedback loops are really important to the process of transition. On the one hand these are barriers that have to be overcome. On the other hand, the more you put vehicles on the road, the more you get people to use them and put the infrastructure in place, the more you generate these positive feedbacks which speed up the transition.

In this model we've actually linked together two of these Lave-Trans models, one representing California and the Section 177 states, and the other representing the rest of the U.S. What happens in California then affects the rest of the U.S. with a one-period lag. And what happens in the U.S. affects simultaneously what goes on in California.

So, if California, for example, puts electric drive vehicles on the road, helps to get some scale economies and learning, there's benefit for the rest of the U.S. which will then spill over. And then as the rest of the U.S. follows along, that spill over will come back to California. And that's represented in the way these models are linked.

This is a very simple choice structure. People buy a new car, they don't buy a new car, they can buy a passenger car or light truck, they can buy one of the types of vehicles with internal combustion engines, or a battery electric or a fuel cell electric.

It's a highly generalized model. There are only two geographic regions. There are only two market segments, innovators and early adopters, and majority. There are only two types of vehicles, passenger cars and light trucks.

We think this is appropriate at this stage because there's a lot that we don't understand very well about how this will work. How many innovators are there? How many early adopters? The majority, what are they willing to pay? How does that change as more vehicles are sold?

These things are not as well understood as they really need to be. The same for the cost of limited fuel availability, the short range for electric vehicles and long recharge times, and so on, and so on.

It's not that we don't know anything and there is good research going on, improving our understanding as we go along, but I think it means that the results of this modeling exercise should not be considered definitive, but rather a way of organizing the best available information we have in a structured framework for trying to learn about how this process may work.

Okay, so just quickly looking at some of the inputs to the model, these are the prices for gasoline and for electricity. They come from the Annual Energy Outlook. No big surprise there.

One thing you'll see is that the blue line, which is no tax cost, diverges from the red line, which is a taxed fuel, because in all of the cases, and we're following the NRC study here, the motor fuel tax is indexed to the average efficiency of all the vehicles on the road.

And because the efficiency of the vehicles is tripling, or more, the tax also increases substantially such that by the time we get to 2050, although the vehicles are paying the same amount of road tax per mile, they're paying about $1.40 to $1.50 a gallon gasoline equivalent.

All types of energy are taxed in a road user fee which helps, obviously, to hold down the rebound effect and helps to finance the road system at the same time.

You see a high price for hydrogen initially and this is just one realization that's sensitive in the model for how fast the demand for hydrogen expands.

But it starts out at a very high price and as demand expands and the volume of production goes up it comes down.

And you see, again, the cost of de-carbonizing the hydrogen is in there. And all of the cases I'll show are for substantially de-carbonized, eventually, hydrogen and de-carbonized electricity.

Important policies assumed and then I'll get on to results. As I said, increasingly strict fuel economy and emission standards, policies to ensure low carbon fuels, gradually occurring over time.

And we assume that the existing vehicle subsidies terminate after 2015. That's probably not going to happen but on the other hand that's when we impose the policies like ZEV, and other subsidies and mandates that ensure that infrastructure is put out and reduce the cost of vehicles to the customers.

And we track all of those costs, so if there are continuing policies they're sort of in those policies that are implemented after 2015.

We take our ZEV requirements from ARB estimates. Of course, there's more than one ARB estimate but this is the one used -- well, the one we used is shown in detail in our study.

I just show here that the assumptions about fuel cell vehicles in this ARB assessment are much lower than, for example, expected by the California Fuel Cell Partnership, and we are using the ARB estimates.

We ran six scenarios. I'm going to focus on three of them. Basically, they differentiate by what are the policies in California and the Section 177 states, what are the policies in the rest of the U.S. and the rest of the world, how fast does technology progress and is hydrogen infrastructure put in place ahead of time.

And, really, it's only worth looking at the first three because the first four -- the last four are very simple and I'll show why as we get there.

So, scenario one is California and the 177 states plow ahead with ZEV mandates and associated infrastructure deployment. The rest of the U.S. doesn't do anything. The rest of the world doesn't do anything.

In section two the U.S. adopts the same kinds of policies as California, with a five-year lag, but as you'll see they don't need to be as stringent because a lot of the heavy lifting will have been done by California and the Section 177 states.

And in the third one the U.S. doesn't do anything about promoting a transition to electric drive vehicles after 2015, but the rest of the world does, and so we want to see how that works.

So, kind of a zero scenario, with nobody doing anything after 2015. Because the battery electric vehicles eventually become cheaper than internal combustion engine vehicles and because they're certainly cheaper to operate, they eventually take a fairly large share of the market, and you see that here.

But no plug-in vehicles and no fuel cell vehicles.

This shows with the ZEV mandates and with infrastructure for hydrogen vehicles, just 68 stations put in place by 2015. You'll get a much bigger response in terms of there being a substantial number of plug-in hybrid electric vehicles and, eventually, a much bigger market share for all electric drive vehicles.

And, certainly, the battery electric and plug-in electric vehicles come in sooner. That helps the rest of the U.S. which had similar results in the zero scenario to California and the Section 177 states.

But with these efforts by California and the Section 177 states, the plug-in vehicles come in much faster in the rest of the country

Now, if the U.S. puts in hydrogen infrastructure, as well, even without additional subsidies for fuel cell vehicles, fuel cell vehicles come into the marketplace after 2035 in a significant way.

And that's because the ZEV standards have essentially done the heavy lifting of driving down costs through scale economies, and learning by doing, getting some makes and models out there, and then the rest of the country benefits from that. And as soon as they put out some infrastructure, things do begin to happen.

And that's an example of the kinds of tipping points that occur in these phenomenon. It's a small change, a small investment of a couple of hundred hydrogen stations in the rest of the country and transforms not only the U.S., but California as well.

Do I know that that's exactly the way it's going to happen? No, I'm not saying that.

But what I am saying is that the processes like this do have tipping points that can be very strong because of the positive feedbacks.

In the scenario two, which is sort of our reference scenario, if you will, for policy, California and the 177 states lead, the rest of the U.S. follows along.

And by the time we get to 2050 almost all of the vehicles being sold have some form of electric drive, whether hybrid plug-in battery, or a fuel cell. And this is true not only in California and the Section 177 states, but in the rest of the country as well, with a slight lag.

This has tremendous impact on petroleum use and greenhouse gas emissions, 80 percent -- almost an 80 percent reduction, about a 78 percent reduction in greenhouse gas emissions.

And nearly an elimination of petroleum use with only 4.6 billion gallons of biofuel in California and the Section 177 states in 2050, a huge impact.

Benefits appear to exceed costs by about an order of magnitude. On the left you see the -- a trace over time. This is a discounted value, but year by year, by year. So, the future years are discounted. We use a 2.3 percent discount rate.

You see in the purple line fairly substantial implied subsidies. These are not necessarily subsidies paid by the government. In fact, the ZEV standards in effect will require the manufacturers to subsidize the vehicles, if necessary, in order to sell them.

But you see that occurring for about a decade. There are -- there is a negative net present value, that's the light blue line, for about a decade. And then the result turns very positive with net present values exceeding the net present cost by about an order of magnitude.

And for the rest of the U.S. the situation is even better because, as I said, California and the 177 states in this scenario have done most of the heavy lifting. And in the rest of the country they get mostly benefits and very little cost.

What happens if the rest of the world goes ahead with the transition to electric drive? This is the scenario we assumed. It's not a complete or wholesale transition to electric drive, but it is consistent with some studies done by the IEA on transitions at the global level, and that's where we took this from.

So, we see some fuel cell vehicles, some battery electric, plug-in, and lots of hybrid vehicles, and still some ICEs.

Okay, so that's exogenous to our model and now we want to see what if the U.S. doesn't do anything to promote electric drive, but California does?

And then we see there's still a substantial transition to electric drive vehicles in California. The hydrogen fuel cell vehicles don't do quite as well as they would if the U.S. were also pursuing hydrogen fuel cell vehicles. And there are no hydrogen fuel cell vehicles outside of California and the 177 states because there's no infrastructure constructed in the rest of the U.S.

However, again, just install a small amount of infrastructure in the rest of the U.S. to get the ball rolling and, bang, the fuel cell vehicles make a very large impact, and much sooner.

So, that's the -- this illustrates the importance not only of what goes on in the rest of the world but -- I mean not only what goes on in the rest of the U.S., but what goes on in the rest of the world, driving scale economies, learning by doing, and creating greater diversity of makes and models.

As I said, the last three scenarios are not all that interesting. Scenario four is nobody builds any hydrogen infrastructure anywhere in advance of sales, and that means the hydrogen fuel cell vehicles never get going.

In scenario five we have better technology. It's like scenario one. It's not as good as scenario two because the U.S. didn't do anything, but it is an improvement on the scenario one.

And in scenario six we have scenario two, which is the U.S. follows California and this shows the resulting impacts of better technology. This is the optimistic technology assumptions of the NRC study. And petroleum use is essentially eliminated. And greenhouse gas emissions are reduced by almost 90 percent; better technology, better transition. It sounds like a pizza advertisement.

Anyway, I think there's some interesting results from this. As I said, it's not definitive but I think we do see some broad patterns emerging.

One, the net benefits of the transition seem to exceed costs by an order of magnitude. That's assuming the technology follows what the NRC study calls their mid-range projection.

But you do need subsidies and you do have to go through a period of negative value.

There are tipping points and these tipping points can be very important. Obviously, we don't know exactly where they are.

There are not only barriers, but there are network external benefits produced by people who adopt advanced technology, electric drive vehicles. They help make the infrastructure more economical. They help achieve scale economies. They help achieve learning by doing. They help break down the risk aversion of the majority.

All of these things are very important, positive feedback mechanisms, network external benefits that accrue to the rest of the population.

And if you don't have mandates or subsidies, these transitions don't appear to happen. And if you don't have hydrogen infrastructure in advance, you don't get the hydrogen fuel cell transition.

And, certainly, it's rather obvious but what happens outside of California strongly affects what happens in California.

So, we are working on a phase two of this study. Those were the results from phase one.

We're looking at the timing of policy actions and how that matters. We're looking at the intensity of policy actions and how much that matters. And we're looking in greater detail at the question of uncertainty and how that affects decision making, if one is risk adverse or not risk adverse.

So, that concludes my remarks. And these are some reports where there's further information available.

COMMISSIONER SCOTT: Hi David, this is Commissioner Janea Scott. Thank you so much for that terrific presentation. I actually have lots, and lots, and lots of questions, but I know we don't have a ton of time.

So one question, I see here your list of resources, does that include a summary or a report of the phase one information that you just outlined for us?

MR. GREENE: Yes, the first report there, the Baker Center Report that is a summary of the information I just presented.

COMMISSIONER SCOTT: Okay, terrific. And I'm wondering if you have anywhere in there some summary slides, because it was pretty interesting when I look at kind of slides -- I mean all of them, really.

But let's see, it's 9 on mine, so it must be page 18 or page 19 in the overall total of zero emission vehicles that you would have, right. So, if they're -- let's see which one did you -- if they're additive, you could add the 30 percent of battery electrics to the almost 20 percent, and then 15 percent. And that's actually a pretty large chunk of the market overall.

MR. GREENE: Yes.

COMMISSIONER SCOTT: And in the scenarios on some of the other pages it's around maybe 65 percent, or 75 percent, kind of depending on the different policies.

And do you have summary slides within the broader report where we can kind of see what it looks like when it's aggregated that way?

MR. GREENE: Well, we have some, but if we don't have what you're looking for we do have that data available and I'd be happy to send it to you.

COMMISSIONER SCOTT: Excellent, thank you.

And then I have one more and then I'll take time to look through the report.

On slide 22 you mention that there are some -- the subsidies, it looks like a purple line on the chart that we have, and I'm wondering what the assumptions are that go into those subsidies.

Are those subsidies sort of shared across California and the Section 177 states? Are those subsidies mostly coming from California, with a little bit from the 177 states? What are the assumptions that go into that subsidies line?

MR. GREENE: Yes, so we are not actually breaking that out and we don't -- we're not able in the model to break out state by state.

You could try to do such a thing based on another assessment of, you know, how many of each kind of vehicle would be sold in the different states.

I think that, you know, because the travel provision essentially is going to, I think, help the sales in California more than elsewhere, most of the subsidies for fuel cell vehicles would be in California, but the rest of the vehicles would be distributed throughout those states.

COMMISSIONER SCOTT: Uh-hum.

MR. GREENE: The model also doesn't say who pays for these subsidies. So, it could very well be that the subsidies are paid by manufacturers, who are required to sell the vehicles in California. And that doesn't necessarily mean that the subsidies would be borne by Californians, entirely.

So, it's not something that our model tries to sort out in detail at this point.

COMMISSIONER SCOTT: Okay, now that's very helpful. Thank you so much for taking the time to WebEx in and share this information with us. It's really interesting. I think it's a terrific presentation.

I don't know if Jim or Hazel, any questions? Okay.

MR. GREENE: Well, you're quite welcome.

MR. OLSON: Okay, thank you very much David. We'll be in touch with you on maybe getting additional information from you.

And now I'd like to turn to our next speaker, who is Eileen Tutt, Executive Director of the California Electric Transportation Coalition, and she will give us some comments on updated electric transportation options that her members are involved in.

MS. TUTT: Well, thank you Tim and Commissioner Scott, and Energy Commission staff.

My name is Eileen Tutt and I'm with the California Electric Transportation Coalition.

For those of you who are not familiar with our organization, we're an organization made up of automakers and utilities, so we are an industry organization, an industry coalition.

But we are in support of electrification of the transportation sector, broadly, because of its environmental and economic benefits.

So, we're interesting in that we do a lot of work with the environmental groups. And throughout the day I've heard a number of things that I agree with. And I think that Dr. Greene's presentation was particularly helpful.

I want to start out with just some of the benefits of electricity as a fuel because I think some people don't -- aren't really aware of some of the benefits that are not as well understood.

I think we all know that electricity, when used in vehicles, reduces greenhouse gas emissions by about 75 percent and criterion toxic pollutants by over 90 percent.

But what you may not be aware of is that these cars get cleaner, these cars, and trucks, and trains and anything else that uses electricity, they get cleaner over time as the grid gets cleaner.

And that's a very valuable benefit. And I want to -- I know that Robert Bienenfeld from Honda would agree with me, and since he's not here you can just all believe it, but earlier he made a statement about how similar fuel cell vehicles are to gasoline vehicles, conventional vehicles.

And I think, you know, perhaps that's true, but I think he would agree there's a lot of customers, and myself being one of them, having driven an electric vehicle for the last 11 years, I like my electric car because it's not the same as a conventional vehicle.

I love being able to charge at home. I really don't like going to gas stations. There's a lot of benefits that make this vehicle more valuable to me. So, I think that's true of natural gas vehicles, of fuel cell vehicles, of all of the vehicles.

So I think, I just don't want you all to leave today thinking that our goal is to make a vehicle that's just like the conventional vehicles today. In fact, I think quite the opposite.

One of the benefits -- Suzanne showed me but I'm technologically challenged.

One of the obvious benefits, and Dr. Greene alluded to this, is just the cost of electricity. On this chart it's the blue line at the bottom. Not only is electricity significantly cheaper than gasoline, at about $1.50 a gallon equivalent, but the red line is the price of oil and the volatility in that price.

And you probably can't see it, but a lot of those spikes are associated with negative economic consequences.

And that's not to be -- you know, to be a dispersion upon oil, because I know there's talk about imported oil and wanting to get off oil, and I think we want to -- the real goal is to diversify the transportation fuel sector which has zero diversity right now.

And because of that our entire economy is tied to the fluctuation in oil prices, and that's just not healthy.

So, the degree to which we can get more electricity, which are the blue lines, significantly cheaper and the price is relatively stable, into the transportation fuels market we're going to see economic benefits quite clearly.

The other thing that I will say is that electricity as a fuel is unlike liquid fuels, and really unlike something like hydrogen and natural gas in that the users are connected to each other. How I use electricity affects everyone who uses electricity.

And that's a huge benefit. So, if we look at the vehicle, whether it's a truck, or a train, or a car, and the electricity grid as a whole, there are ways to leverage the benefits to the advantage of the consumer, and I think we want to do that.

Finally, I just want to point out that electricity is a very, very highly regulated fuel. And that's good because how the utilities make money and spend money is transparent to all. Your pricing, the price you pay for electricity, you have a venue to complain about it and the utilities are held responsible, and there are hearings, and there's all kinds of things.

So, I guess the economic benefits and the stability of that price translates to a consumer benefit that is unique to electricity.

I do want to talk a little bit about the market status of electric vehicles. And Philip talked about it this morning a little bit, and he's right, so I'm going to reiterate that.

Electric vehicles in California are selling at three times the rate they are anywhere else.

And I think that's a testament, to be honest, Commissioner, to California policies and the people of

California. We care about the environment, we're not technology adverse.

But, really, the policies of the State are significant drivers.

Beyond that the vehicles, plug-in electric vehicles are selling at three times the rate that conventional hybrids did when they first came out, which I think is -- again, and this is directly to what Dr. Green said, people have become more comfortable with electricity as a fuel just because of the use of hybrids, and hybrids being in the market, even though they don't plug in.

So, we all benefitted from that and we're seeing the benefits in the market.

I like leaving this slide up here for a while, just in case you all are wondering why I haven't moved it, yet. I just really like that slide.

So, that kind of leads us to an assessment we did that we also gave to the docket here today, and that is we looked at just electricity vehicles, just light duty electric vehicles because we have the most information on that.

If you accelerate the rate of deployment of light duty vehicles into the market, what does that -- how does that impact the economy?

And, you know, you can kind anticipate, like I said there's sort of intuitively diversification of the transportation fuel sector is a good thing, a lower cost fuel is a good thing. All of those things are intuitive.

But UC Berkeley did this work for us using a model called the BEAR model, not surprisingly, that has a very good reputation. It's been peer reviewed. It's been used for a lot of California policies.

And we looked at these three different scenarios. One was sort of the reference case or baseline and then we looked at what if you deployed electric vehicles at a rate so that 15 percent of all new vehicles sold in 2030 were plug-in electrics, and then we looked at a more accelerated rate of 45 percent of all new vehicles being plug-in electric vehicles by 2030.

And these roughly correlate to the -- the 15 percent is roughly correlated to the ZEV mandate, the 45 percent is roughly correlated to the 80 percent greenhouse gas reduction goal that we have for 2050.

So that's where they -- it's not really intended to be support for the mandate or the programs, but we did want to correlate it with State policy on some level.

And what we found here, and I should have actually fixed this slide because we actually don't know down to the single digit places how many jobs are created, but it is a macro economic model.

But what we found is that gross State product grew, which is a good thing, as the number of electric vehicles, plug-in electric vehicles increased.

And that jobs also grew. And you'll see about 50,000 new jobs in the 15 percent scenario and about 45 percent new -- I'm sorry, 100,000 new jobs in the 45 percent scenario.

And a lot of people ask, and I'm sure you're dying to know, why isn't this a linear -- why isn't this line linear? Why is it twice as much and not three times as much when you go from 15 percent to 45 percent?

And the reason, again, hearkens back to what Dr. Greene said, and that is that we assume incentives go away over time. And so in the early years the incentives basically are a stimulus for jobs and economic wellbeing.

And so you'll see that as the incentives go away we still get jobs growth, no question about that. But the incentives in the early years really do -- are really good for our economic wellbeing and jobs growth.

So, please, AB 118, let's pass SB 11, AB 8, let’s increase the number of incentives available, which is my next pitch here. But these are very important programs.

In terms of just the employment effects and I don’t really -- I don’t know why I included this slide, but it’s so simple in a way, which is why I like it.

But basically, when you think about jobs creation this isn’t just batteries being built or new Teslas in California. The reasons that jobs are created when we move to electrification is twofold, really, the major reasons.

One is that the electricity sector and the automobile sector create more jobs per dollar spent than the oil sector.

So, when you move your expenditures from a less job-intensive sector to a more job-intensive sector you get jobs creation.

The other piece is that when people save money on fuel, they tend to spend that money on entertainment and healthcare. And those are local industries that create jobs here.

So these are not necessarily direct jobs, they’re more jobs that are created as a result of these other factors.

The blue is -- there is a slowing in job growth.

So, I don't want to say job losses because that's not actually the case. But we do see in the oil industry, you see job growth does not increase as fast, which should be anticipated.

It's just that because of this transfer, you know, you create more jobs in other sectors.

I'm going to move quickly to the policy drivers here that I think are really important. And I'm just going to say that the number one barrier for plug-in electric vehicles in the market right now is the vehicle cost.

So, the number one way to overcome that barrier is for the State to provide an incentive that reduces that up-front cost. And the State does through the Air Resources Board's Clean Vehicle Rebate Program, and they also have a heavy-duty vehicle program.

And so that -- not only, as I showed earlier, does that create jobs, but it does help -- it's a direct message to consumers, the State is going to pay you to do this thing.

And that's a very powerful message. Right now -- and there's other benefits of that. I'm not going to go into all of the benefits of these two programs.

But I will say that right now both of these programs -- for the last three years the light duty program has run out of money.

And thank you, Commissioner Scott and Energy Commission because you've bailed out that program for three years in a row now. And that's not a sustainable way to keep moving forward, which is why I'm saying we need to pass AB 8 and SB 11. But we also need to think about how we get more revenue into these programs so we don't rob from other very important work that's being done here at the Commission.

The heavy duty vehicle incentive program ran out for the first time this year, and that's a big deal because these -- to be honest, these truck fleets and all that, they aren't going to buy -- they aren't going to buy these cars without the incentive.

I want to highlight something that Simon actually said earlier, from NRDC. He said we need to think about going forward with these incentive programs. And I think David Greene said it, too.

Right now the State has not plan for the incentives. They don't -- we haven't looked as a State, as policymakers or as stakeholders of how much -- what are our objectives? How many vehicles do we need to get to? What are the costs? When do these incentives taper off because we don't need incentives in perpetuity?

And how do we -- and where's the revenue going to come from to help us meet our objective?

And if our objective can't be met because there's no revenue, then let's look at what the objective ought to be.

So, we need to do that in a real honest way and we just haven't done it.

So, I'm going to ask today, you know, this is the IEPR after all, I think it's very important for us to think about going forward what do we want to accomplish? What do we need to accomplish it? And is it possible? And if it's not, let's reset our objectives or our goals.

Let's not keep going forward. Because I'm telling you right now we're headed off a cliff with these incentives.

So, by the end of the year, suddenly, people who thought they were going to get money if they bought a light duty car, or an electric car, or an electric truck there will be no money there.

And there is nothing worse for the market than that kind of uncertainty. We just can't do it and we can't continue to raid from the Energy Commission.

So we, CalETC, and many of our members, and our coalition want to work with you at the Energy

Commission, and everyone in this room to figure out how we look at a more sustainable plan.

The other thing that I just -- I have to talk about, of course, is the infrastructure incentives, because the Energy Commission runs the AB 118 infrastructure incentives.

And for plug-in electric vehicles it's been a great program. And the only thing I would say here is that we have -- you know, the Energy Commission has been very thoughtful in how they disperse that money. It's gone to a lot of like the challenges, multi-unit dwellings, workplace, that kind of thing.

The PUC and NRG came up with an agreement and the NRG is spending a bunch of money helping multi-unit dwellings have electric charging. This is very good.

But the thing that's kind of overlooked in the market, that we've learned, is that a lot of people, myself included, are buying these cars, driving them home and plugging them in at home, without any home recharger, we just plug them into the wall, in the garage or, in my case, carport outlet.

So, you don't need, necessarily a charger. If you're someone like me and you spend most of your time not driving, which I think is probably most of us, and your car is parked probably 23 of 24 hours, if not, you know, 20 plus hours. That's plenty of time to get a charge with a level one charging -- charger.

So, for places like airports, hotels, home, workplace we need to -- we need to really think of this because it is a -- it's kind of a low-cost, very efficient way to get electricity into vehicles and it's good for the grid as a whole, as well.

So that's something that I think in terms of infrastructure there hasn't -- you know, we get excited about getting public infrastructure out there, getting fast chargers. And we definitely need those, there's no question. That does drive the market and more people will buy the cars if they see the infrastructure.

But we need to recognize the benefit of these low-level chargers, as well.

And then, you know, for Mike Waugh I have to say that the low carbon fuel standard, and for everybody in this room, is really -- and let me see if I have a -- I'm sure I have a slide on that one. Oh, yeah.

LCFS is one of my favorite policies of the State, the Low Carbon Fuel Standard, because people often think of it as a biofuels regulation. The Low Carbon Fuel Standard is driving clean fuels.

Electricity happens to be the lowest cost, lowest carbon fuel available today. And the way the Low

Carbon Fuels Standard is structured recognizes that and rewards that.

This policy has -- you know, we started out, I think, six, seven years ago -- Mike will know better than I -- remember, but my brain, the last ten years I get confused about different time scales. It happens.

But we started out thinking, having scenarios that the Air Board created and we all thought about, you know, that we thought, okay, this is how the Low Carbon Fuel Standard is going to be met.

Well, as you heard from Philip earlier, it turns out that that may not be the way the Low Carbon Fuel Standard is going to be met. There's been a number of sort of disruptive, if you will, in a positive way surprises, natural gas being one, electricity being another, renewable diesel being another.

And so, now, we're at a place where the market has innovated in ways we didn't expect. And that, to me, is a success, a regulatory success.

So, I think of the Low Carbon Fuel Standard as an extraordinarily successful mechanism to really de-carbonize and certainly reduce the carbon content of our fuels.

So we did, and I'm not even going to talk about it except to point out the results. You know, we were one of the funders of the study you heard a lot about from Philip earlier, and we just are very supportive of the Low Carbon Fuel Standard and believe that it is doing exactly what it was intended to do.

And in case anybody's wondering, it's not just -- the intention is not just to stick to liquid fuels, the intention is to get to low carbon fuels.

And so, you know, we've been very pleased with the work that ICF did and we believe that the Low Carbon Fuel Standard is attainable through 2020.

So, we are not concerned about it. We will continue to work with CARB and other stakeholders as we go along to see, you know, what new technologies come out of all of the innovation investment that's happening.

But, you know, like David Greene, we aren't going to predict the future, we're just going to say that the nice thing about the Low Carbon Fuel Standard is it doesn't predict the future, either. It just says market do what you do, innovate, and give us the lowest carbon fuel possible.

So, I'll just close by saying that there's a couple of lessons learned that I want to reiterate.

One is that for the AB 118 program, as Simon said, I'll again say -- Simon says, so it must be right.

We have to have to have more money for incentives. We're running low. And so we need to pass SB 8, SB 11, and AB 8, but that's not going to be enough to provide the incentives to get where we need to go, and I think Dr. Greene made that clear.

Additionally, we need to have a plan. Because I'm telling you what's happening for me, when I go over into the Capitol, or otherwise, and talk to policymakers is when it looks we don't even know when -- it just looks like we want more money that is not -- it's just not a good plan to go in and ask for more and more money.

You have to look out and see how long do you need the money? When does it ramp down? It's not in perpetuity.

Perhaps electric vehicles need less and less money, but fuel cell vehicles are coming into the market and they need more.

We need to look at all of these things honestly and come up with a plan, together.

I also just want to reiterate the importance of level one charging so that we don't -- you know, don't forget that not only does it make these vehicles more accessible to more people, but it's less expensive and it's good for the grid in general, which is good for all electricity users.

Of course, the LCFS is working as it’s intended.

And then my final statement today is going to be about the PUC. I haven’t talked a whole lot about the PUC proceeding around electric vehicles.

But I will say this, you know, the PUC decided to kind of keep utilities out of the infrastructure market and they limited the amount of education that a utility is allowed to do.

And I’m not going to say whether that’s a positive or a negative, but I think we need to relook at that and think about, you know, providing more flexibility. Because we have seen some market failures and we have seen some market disruptions that might -- may not have happened.

And I think the fact that NRG, largely a utility, has come in and done some really good work ought to be looked at. Particularly as we go forward into the heavy duty market, and the next proceeding at the PUC is the heavy duty market.

And then, finally, I just want to say that -- and this is true of all of the alternative fuels, but I’m electricity, so the fact that I own an electric car, and the State gave me money to buy an electric car, that benefits everyone whether or not you buy an electric vehicle.

You're going to benefit from the fact that I emit zero emissions; they're very low even when you include the utility emissions, and all the jobs that were created as a result of my buying that car.

So, go out, buy electric, have a great day. Thank you for the invitation to be here today.

COMMISSIONER SCOTT: And thank you for coming, another terrific presentation.

I do not have questions. Do you all have questions? Okay, no, we're good.

MR. OLSON: Okay, thank you, Eileen.

The next speaker is Catherine Dunwoody, who's the Executive Director of the California Fuel Cell Partnership and she's going to give us an update, rundown on hydrogen fuel cell electric vehicles and hydrogen fuel infrastructure.

MS. DUNWOODY: Okay, thank you, Tim. And thank you, Commissioner Scott and members of the CEC staff for inviting me to discuss fuel cell electric vehicles and hydrogen today with you.

Fuel cell vehicles are on the road today in California, and they're fueling at a handful of stations.

Our goal at the California Fuel Cell Partnership is to bring fuel cell vehicles and fuel cell buses to the commercial market.

We are a public/private collaboration of auto companies, energy companies and government agencies that are all working together towards that goal.

So, this is a picture of three customers fueling at the hydrogen station in Torrance. And I like to use this slide just to remind everyone of some of the benefits of the vehicles that we're talking about.

Fuel cell vehicles are electric vehicles, but they don't plug in. They refuel with hydrogen at a station like this one, in Torrance.

They are zero emission vehicles. They go two to four hundred miles of drive time on a tank of fuel, and they take minutes to refuel, giving us between 60 and 90 percent reduction in greenhouse gas emissions, depending on how the hydrogen is made.

The car doesn't care how the hydrogen is made so as we go forward and we move towards more renewable and low carbon forms of hydrogen, the emissions will be reduced, similar to plug-in battery electric vehicles.

Four -- or five of the automakers have cars on the road here in California today, and three transit agencies are operating fuel cell buses.

And I just want to say, quite frankly, these cars are great. I drove that red car here today, it's the Honda Clarity. And if anyone is interested in having that experience of driving the fuel cell vehicle, I know Commissioner Scott you had an opportunity when we had a ride and drive here. But sometimes you just want another change so, please get in touch with us and we'll make sure to get you into a car.

So, today I want to make three important points about the potential for market growth of fuel cell vehicles here in California.

Industry and governments are making significant investments in fuel cell vehicles on hydrogen today. And it's because this vehicle makes sense.

You already heard reference by David Greene to the National Research Council's study that was published in March of this year, and their goal was to find scenarios for alternative vehicles and fuels that would reduce oil consumption and greenhouse gas emissions by 80 percent, below 2005 levels by 2050.

The report identified several vehicle and fuel scenarios that could achieve these goals and I'd like to point out that the scenarios that achieved the greatest reductions all include fuel cell vehicles.

And important finding from this report is that for new advanced technology zero emission vehicles, like fuel cells and battery electric vehicles, to be a majority of the fleet in 2050 they need to represent a significant fraction of new car sales by 2035, which points to the importance of starting now to launch a market to enable that growth to occur.

The report had a lot of findings, a very important piece of work. I encourage everyone to read it and gain insights about the different scenarios that they analyzed.

But today I just want to highlight a couple of points from their fuel cell vehicle and hydrogen cost analysis.

NRC's analysis showed that fuel cell vehicles can be competitive with other electric drive vehicles at production volumes of about 200,000 per year.

Some people say, well, what does that mean, you know, 200,000 per year?

Just to put that in context, in 2012 Toyota reports they produced 600,000 Prius', so that's one-third the last year's production level.

With further technology advancements and improved supply chain costs for a fuel cell vehicle could be lower than an equivalent internal combustion engine vehicle.

And I think you heard that similar -- you know, it's the same conclusion that David mentioned in his presentation.

Fuel cell vehicles are expected to be equivalent in range and refueling time to internal combustion engines, and to be able to give customers the performance that they're used to having today.

Also interesting, looking deeper into the source of the cost reduction projections is that to look at the fuel cell system costs. And I added some emphasis here on their wording that "the primary economy of a scale occurs at 50,000 units."

And so going back to Prius production, that's like a 12th of the production in 2012, and it's also about the same number of new vehicles that are registered in the Bay Area in the first quarter of 2013, so just to put some scale on that.

And this points to the value of ensuring that fuel stations are available to support a market launch so automakers can achieve these economies of scale as quickly as possible.

Also, looking at the cost of hydrogen the NRC's analysis shows that hydrogen can be competitive with gasoline today, and it could be much less expensive once fuel cell vehicles are on the road in large numbers, and we have a true market for this as a vehicle fuel.

It’s important to note that for looking at -- comparing hydrogen costs to gasoline costs, the fuel cell vehicle travels two to three times as far as an internal combustion engine on the same amount of energy. So, $10 a kilogram for hydrogen equates to $4.00 a gallon gasoline.

And in the future, with projects at $4.00 a kilogram of hydrogen, that would translate to $1.60 a gallon of gasoline

So, future vehicle volumes depend heavily on the infrastructure being available to enable market launch and ramp up production volumes to achieve these economies of scale and bring the costs down.

And California is working very hard, and through the Energy Commission. Thank you for your support of incentivizing the fuel infrastructure to enable this market launch in the 2015 to 2017 time frame.

These are smart investments that represent the State’s commitment and partnership with the other market participants who are participating here with investments from the auto companies, and the fueling infrastructure providers, as well.

And as we heard from David, we need to continue these incentives. They need to be strong and durable through the transition years and this could be over the coming decade and beyond.

So, automakers today are doing their part to make great vehicles. According to the industry surveys that were recorded recently by the Alliance of Automakers, they have invested a combined $9 billion in research, development and demonstration for fuel cell electric vehicles.

And they have announced partnerships and production plans beginning in 2015.

But before automakers can begin marketing fuel cell vehicles to customers, those customers need to know they'll be able to find fuel where they live, and they work, and they want to travel for recreation.

They have to know that their fuel cell vehicle is -- the fuel cell vehicle is a no compromise vehicle as long as there are hydrogen stations available to fuel it.

So, we have a plan, it's our California Road Map, it was published in 2012, to ensure that those early market customers can travel and fuel as conveniently as they do today with gasoline.

And it calls for a minimum of 68 stations for market launch, growing to around 100 to sustain market growth through that early market transition.

And we will be submitting that road map to the docket. But I'm going to go through a little bit of that here today.

But just first to point out that the State and particularly the Energy Commission has taken a leadership role in providing cost share for the current network of stations, and it's supporting the growth of that network such that with the current funding that's been allocated and in play we can expect between 25 and 30 publicly accessible hydrogen stations in place by 2015. So, we're almost halfway to our goal.

The road map calls for stations to be located in five early market communities. These were identified based on a number of different information sources. Some of them confidential automaker market assessments, but we were able through the Partnership to get the automakers to collaborate and to come to consensus on the areas where they want to see the investments occur to launch an early market.

Also, demographic information, publicly available sources such as the ARB-CEC Vehicle Survey results, hybrid and alternative fuel vehicle registration data, and the geographic distribution of the Clean Vehicle Rebate Program.

So, together this information indicates the markets where automakers are most likely to find their first fuel cell electric vehicle customers.

And then within those communities we worked with UC Irvine and they used their STREET model to show how many stations would be needed to provide those customers in those communities convenient access to fuel. And they defined convenient as less than a six-minute travel time to a station.

They based their six-minute criteria or tipping point based on previous optimization research, drive behavior surveys, and a need to balance the strength of the network with the cost of the network.

So, in those communities this equates to having hydrogen at 5 to 7 percent of existing gasoline stations. And at that penetration, the stations can then support commercial volumes of fuel cell vehicles, which will then spur throughput and put stations on a path to achieving a sustainable business.

This map shows the initial hydrogen station network in California and it can put the first 20,000 fuel cell vehicle customers within those communities within six minutes of a hydrogen station.

But you'll notice it also, very importantly, puts stations in the destination and connector communities where people need to travel.

So, many of those connector communities also become the seeds for the next market cluster. And the network can then grow from there.

The basic premise of the road map is that first you need to build for coverage. You need to have enough stations so that customers can get access to fuel.

And, initially, that network of stations is going to be under-utilized. That is that it's going to have far greater capacity to fuel cars than there are cars on the road.

But through this coverage customers will gain confidence that they can fuel when and where they need to, as easily as they do today.

But the businesses that are offering this fuel will need incentives to offset the early operating losses due to low throughput.

Because hydrogen, like all fuels, will be a volume business and that's how the profits will come in is when it gets to volume.

When 68 stations are in place, fuel cell vehicles can enter the market in larger volumes and the station network will then need to expand to provide the capacity to fuel those additional vehicles, and that is what will signal a launch of the early commercial market.

Now, as I mentioned California is certainly in a leading role here, but we are not alone. Germany, Japan, the UK, Korea, Scandinavia all are investing and have plans to build hydrogen fuel station networks to support the early market launch.

And this is very important to automakers because they need to have confidence that enough regions will be ready to absorb the volume that they want to produce when fuel cell vehicles come to market. And one market won't necessarily be sufficient for them to achieve economies of scale.

So, at the same time these markets do need to be focused so that automakers can provide the support that a new advanced technology vehicle requires.

And I would also like to point out here that we have a new initiative that's been launched at the Federal level that is called H2USA. And the idea there is to take what we have done in California and begin to apply that to other parts of the country in terms of network planning and preparation for market launch of fuel cell vehicles in other states. For example, the northeast and other states that have taken a leading role in the ZEV program, as well.

So, the third point is that ultimately, of course, the customer is going to decide whether an advanced technology vehicle and fuel will be successful.

The customers must be able to gain value from their purchase.

California's incentives programs, such as the AB 118, and both at the Energy Commission and at the Air Resources Board are important elements of demonstrating value to the early customers.

And, of course, the automakers and the station providers have to continue to provide great products, great vehicles and great stations to make sure that customers are pleased.

And I would say today early customers are delighted with their fuel cell vehicles, and their fueling experience, although they certainly want more places to fuel. That is definitely clear from the comments we hear.

And, you know, based on this we know that fuel cell vehicles can be a commercial success. All of the ingredients are in place; performance, durability, cost reduction potential and affordable fuel.

So, the ingredients are there and we need to continue to work towards launching that early market with sufficient stations so that the vehicles can come to market.

Supporting the customer value proposition today will enable that market launch and growth of fuel cell vehicle, along with other ZEVs. And I firmly believe that fuel cell vehicles will play a big role in achieving this goal of the Governor's here by 2025, to have over 1.5 million ZEVs in California.

We're working together at the partnership to reach out to communities to prepare them to become hydrogen ready, and also to address the remaining coordination and technical implementation challenges of getting stations in the ground.

And with that I thank you very much for your time and would be glad to answer questions.

COMMISSIONER SCOTT: Thank you for that great presentation.

I did have one question for you in terms of the -- you mentioned a few slides back about California having a leading role in helping to get the fueling stations out there, and you listed several other countries, like Germany, Scandinavia, Korea, Japan and the UK.

And I'm wondering if you have had an opportunity, or maybe some of the members of the Fuel Cell Partnership to trade information and data, and sort of share lessons learned about the early experiences that were having here in California with folks and the early experiences they're having setting this up there?

MS. DUNWOODY: Yes, in fact we collaborate quite regularly through both in-person and, you know, remote communications on many of the challenges.

For example, there was a meeting recently in Germany, which one of my staff was able to attend on the technical infrastructure challenges, and we did talk extensively about the metering issue, and need for advanced meter development.

So, there's quite a bit of collaboration. And we face many of the same challenges.

And I think, you know, as I like to say it's, you know, the technical challenges are actually -- they're quite achievable or manageable compared to right now, really, the business challenge and the fact that, you know, there is no clear initial business case for private investment to come in on its own to build these stations which is why the government investment, through the incentive program, is such an important market driver in this early phase.

COMMISSIONER SCOTT: Thank you for that.

And I know Commissioner McAllister mentioned before lunch that he had enjoyed his opportunity to ride in a fuel cell car. I also did when you brought the cars over before our June business meeting. And it was great because I got to ride in one that was both where they had sort of swapped out the internal combustion engine and put in a hydrogen, and also one that had been designed from the ground up to be a hydrogen car, a fuel cell car. And so it was just a great opportunity for us to get to experience those. So, thank you very much for bringing those over.

MS. DUNWOODY: Thank you.

COMMISSIONER SCOTT: Okay, thank you.

MR. OLSON: Okay, we're going to go to our final speaker in this electric transportation hydrogen section.

And to give you a little bit of a frame of reference, when we were doing our assessments of what the contributions are for different electric drive type of applications, electric vehicles are expected to be a large part of that.

But we think the next largest contributor or user of electricity in the full build out of the system will be the high-speed rail project in California.

And as leading to our next speaker, is Mark McLoughlin, who is the Director of Environmental Services for the California High-Speed Rail Authority.

And Mark, I think you're going to speak up --

MR. MC LOUGHLIN: Thank you very much. Again, Mark McLoughlin, I'm the Director of Environmental

Services for the California High-Speed Rail Authority.

I'm here today, I'm going to give a short presentation, an overview of the project, and we'll present our current assumptions on our load forecasts, and also note a few areas where the Authority is stressing the use of renewable energy throughout the program and, specifically, in our first construction project.

Today, also here is Christine Schutt, of our Legislative Office, and also Meg Sederoth (phonetic), of Parsons Brinckerhoff, and our PM key program management team.

And Meg has played a strong leadership role in the architect of our sustainability program.

So, this map right here shows the overall project on a program level. Right now the high-speed train system will connect California cities with clean, fast, modern passenger high-speed rail in a full system.

The trains will be fully electric and capable of over 200 miles per hour at full speed.

This will carry the passengers from the growing populations of the San Francisco Bay Area to the L.A. Basin in under three hours.

So, the way this map is set up, it's currently set up for our latest 2012 business plan that was adopted just last year.

This took a strong look at implementing the system in phases, much like how Germany, and Japan, and France have implemented their systems.

A couple of things we'd like to focus on is on the initial operating section which in 2022 will connect major population centers in the Central Valley and fill the existing rail gap between Bakersfield and the San Fernando Valley.

And a couple key milestones to note, also, is that the first environmental document for Merced/Fresno was certified in May of 2012. Our first construction package, which we call CP1, for the Merced to Fresno section, the execution of that contract is imminent with design, and possibly early construction by late this summer.

So, we're very excited about that key milestone as we get underway with construction.

That first contract package is roughly a little over $930 million.

And the next environmental document that we have currently, that we're looking to get certified for the EIR/EIS is in probably spring of 2014 for Fresno to Bakersfield.

Right now the project is moving forward in our preferred alternative phase and working out specifically some issues on the alignments in the Wasco/Shafter area, and Bakersfield.

We want to make sure that the stakeholders in this area -- they have strong opinions on the project and we want to make sure we can address the project through those communities, whether those are large or small.

A couple notes, also, is the early investment commitments that the Authority has made, specifically to CalTRANE in the San Francisco Peninsula for electrification and Metro Link, also in the South area. And again, the initial operating sections, Merced to San Fernando Valley, and the Beta Basin of San Jose to San Fernando.

Phase one blended again, San Francisco to L.A., Union Station to Anaheim, a little over 500 miles.

Phase two portion of the project is really Merced to Sacramento, and then L.A. to San Diego.

Also, the system will also expand from these ends, you know, the Bay Area and then the Southern California to connect the Bay to Basin in 2026.

And finally, the full phase one blended system by 2029.

So, roughly over 15, almost 20 years to build that first section and it's quite daunting as you look at the overall system is about plus or minus 40 years by the time it's all done.

And the main goal is to close that gap in that L.A. Basin over the Tehachapi's and that section alone, the tunneling in that Bakersfield to Palmdale area, will take plus or minus nine to ten years. So, it's a kind of a daunting project.

Let's see, I'll move on here. Here's what we came -- I want to get to the part of why we're here today. I want to talk about the current load forecast for the high-speed rail system. We have the initial operating segment, the Basin to Bay, and then phase one blended.

Our electric system will provide traction power that enables safe, efficient and reliable operation of the trains per the current operation plan.

We will have 12 trains per hour, per direction, including 12 south and 12 north.

As this slide shows, we have forecasts of the gradually increasing load for traction power in time for the geographic phases and in tune with the way ridership ramps up or gradually increases as phases of services are introduced.

Also, I wanted to note also that the Authority is engaged with PG&E in Northern California, and Southern California Edison, currently, also with the CPUC on providing power to those northern sections and in the geographic area of Edison.

One of the things right now is to get over the Tehachapi's. There's currently not a source of power there so we have to build that power to supply that, and we're working with the resource agencies on bringing through a green field area, so to speak, in those Tehachapi's.

So for some details, we grow from .4 gigawatt hours per day in 2022 to 2.3 gigawatt hours per day in 2029 when the full phase one blended system is in operation.

We have been coordinating with the Energy Commission so that detailed assumption within these high level numbers we're presenting today are incorporated in the IEPR.

So, our net goal is 100 percent renewable energy. And in 2008 the Authority Board adopted a policy goal to run the operations with this 100 percent renewable energy.

Through subsequent planning, and active engagement and coordination with the sister agencies that we have, and the Energy Commission we have determined that the most effective, feasible way to provide this 100 percent renewable energy for operations is to procure and produce enough renewable energy that can feed into the grid and offset the amount of energy that the system uses, which enables our net zero approach.

One thing we’ve been actively doing recently, with Meg’s help, is we’ve engaged with the Air Resources Board and Energy Commission with this first phase with the contractor. We want to ensure and meet with them; that there are renewable fuels available to him for this first construction segment and that he can take advantage of that.

If we can make a business case for him to utilize that, we think we can do somewhat of a pilot project with him, including his latest tier engines that we’re requiring.

The other thing is on the construction that percentage of biofuel renewable diesel, and then we also have -- we’re going to be able to track the energy use within the project, including all of the other environmental commitments that we have.

For the project we have over 600 right now in our mitigation monitoring plan, and that doesn’t include permits to come from resource agencies and other permits, and requirements.

The Authority has developed a system we call EMMA, which is going to be able to track, in a share point database, all of those commitments, the contractor’s compliance, and also we’re going to provide folders for all the regulatory agencies to access their permits and those environmental commitments.

So, we’re trying to be as transparent as possible in what we say we’re going to do, and the end result, and to ensure that we can keep the project in compliance and keep building.

Thank you. Any questions?

COMMISSIONER SCOTT: Thank you. I do not have questions. Jim or -- thank you.

MR. MC LOUGHLIN: Thank you.

MR. OLSON: Thank you.

Okay, so we will go on to our next session which is the natural gas transportation. And to start off we’re going to have kind of another overarching type of presentation given by Rosa Dominguez-Faus, UC Davis Institute of Transportation Studies and the Graduate School of Management.

She’s a colleague of several people there, including Amy Jaffe and Sonya Yeh, who are doing a lot of work in this area.

And we've asked her to kind of discuss some of the impact of the pricing of natural gas and where the natural gas transportation options might occur.

MS. DOMINGUEZ-FAUS: Thank you, Tim, for the introduction. I'm substituting for Professor Amy Jaffe, who is the leader of the natural gas as a transportation fuel research.

And I'm going to try to summarize our results from several groups at the School of Management and the Institute of Transportation Studies at UC Davis, as Tim said.

Our questions are -- can you hear me well?

How sustainable is the shale revolution in the United States?

What is the potential for natural gas as a direct or indirect transportation fuel in California in the light of the shale revolution?

And what are our initial scenario analyses, as well as other sources show about the potential for natural gas to displace petroleum and reduce greenhouse gas emissions, and improve air quality in the U.S. and California.

So, about resources, we have lots of natural gas since the onset of the shale revolution about ten years ago. Hydraulic fracking in combination with horizontal drilling have -- we can produce lots of -- vast amounts of natural gas with these techniques at very low cost.

Shale gas is widely distributed in the U.S. geographic region. Breaking in costs are around $4 per medium btu of natural gas. It can be even lower.

In some sweet spots, in some of the dry shale places, breaking in costs are around $2 per medium btu, and in some places is actually zero because it's gas, as I stated, with the production of oil.

So, we have, basically, gas that is subsidized with the production of oil that's -- well, we're seeing it more increasingly because oil prices are very high.

So, we see our projects are that these surpluses of cheap natural gas are here to stay for a while. What this graph is showing, the total resource of natural gas. We have in red is conventional natural gas. In green is associated natural gas from the production of oil. In purple we have shale gas.

And in blue we have backlog gas. And this is gas from dry gas wells that have been drilled, and could be producing, but are not being producing because, basically, the price of natural gas is too low. There's no market for this natural gas.

So, prices are to stay low for a while because, as you can see, the share of associated natural gas, the resource of -- the part of natural gas that's going to be very cheap is increasing. And even if we, when we need to drill just dry gas wells, innovation might drive costs down.

So, we think prices of natural gas are going to stay down for a while.

And what's driving the penetration of natural gas in transportation is the differential of prices with oil. And we see that historically oil prices have been a little lower than natural gas, but that's changed recently and we have natural gas that's much cheaper than oil.

But will that remain? That's part of the modeling that we're conducting. There's many factors that affect these price dynamics. Wow, there's so many because I chose to show it in pictures because I thought that would be better than a thousand words in here.

So, on the left I have the factors that bring the price down. Lots of shale resources right now in the U.S., not enough demand, and we don't have a lot of -- we have a lot of storage capacity, but we used to have more resource. So, it's not that we can bring it to -- we don't have enough pipeline and storage capacity to take care of it, so we cannot bring it into the market. And a lot of it is being flared or vented, about 30 percent is being flared or vented.

So, there's just lots of natural gas supply and not so much demand. That brings prices of natural gas down.

In the middle column we have the factors that could bring prices of natural gas up. Demand in the power sector. With the new Obama energy plan we'll see less coal in electricity production generation. We'll have more renewables and those will come with natural gas -- renewables are intermittent and they need to be backed up with another source of fuel, and we use natural gas in the U.S. And that's a good thing because that's driving CO_2 emissions down.

In Germany, for example, they're backing up renewable power with coal and that's driving their CO_2 emissions from power generation up.

Another thing that will create demand for natural gas is, well, we've talked about before in this forum, is the manufacturing renaissance that is believed to happen in the U.S.

Also, planned capacity for ethylene cracking that comes from natural gas and, as you may know, it's feedstock for a lot of manufacturing products.

We might see more LNG exports. A couple of export facilities being planned in the Gulf, although that's going to be a little more limited than most people think.

Just this week a *Washington Post* article showed how there's going to be a market for only maybe five export facilities.

There are other sources of demand of natural gas, like vehicles. And also, globally, we're seeing a decline in nuclear power and that might produce more -- might create more demand of natural gas for the power sector.

And then we might have relations or concerns of safety and the environmental concerns for fracking that, you know, limit the amount of supply and, therefore, we might see prices going up for these reasons.

But we think there's a lot of resource and that there's a lot of innovation going on to take care of environmental concerns, green completions and everything to maintain -- to reduce methane leakages, to reduce or eliminate the use of water, and even to bring costs of producing natural gas down in the future.

So, price forecasts. We don't have our own forecasts, yet, so what I'm showing here, it's DOE forecasts. And you can see that on the left graph it's oil and on the right-hand side graph is natural gas. In the first period, at 2010-2020 of natural gas, we see it’s going to be around the $4 per medium Btu, which is what we’re seeing today, $2 to $4.

And then it’s going to increase from $4 to $6, and then $6 to $8. Those are DOE forecasts.

We think that’s pessimistic. We think it’s going to stay lower than that.

And also for oil, but oil has a different context with lots of the resource coming from the Middle East which, as we know, it has its own set of problems.

But nevertheless it’s one thing is the price of the commodity at the well and then the price of the fuel at the pump.

And a 50 percent increase of natural gas at the well is translated to a 10 percent increase of the natural gas fuel at the pump; whereas a 50 percent increase of oil commodity at the well translates into a 30 percent increase of oil fuels, gasoline or diesel, at the pump.

So, in other words, LNG and CNG are more shielded against variations in natural gas price fluctuations that gasoline and diesel are from oil filtrations.

So, that was for the fuel side. Now, let’s see what’s happening in the vehicle side. Lots of resource, so producers are trying to find demand.

And we see the example is the State of Oklahoma, where it's having this initiative of creating demand for natural gas. Natural gas production is important in this state so they want to help it.

So, they're negotiating -- and one of the problems with natural gas vehicles is that they have higher upfront costs. The vehicles, themselves, are more expensive than their counterpart, the petroleum counterpart, right.

So, what they're doing is negotiating lower price with original equipment and manufacturers.

The other thing they're doing is taxing CNG at the pump and using those funds to subsidize filling stations, fueling stations, and home refueling stations in order to overcome the problem of the lack of fueling infrastructure.

This is an example that we got from the Secretary of Energy, at the State of Oklahoma. This is showing the cost of some of the vehicles before and after the deal, some savings up to $6,000 per vehicle in some of the models.

Some of the models are bi-fuel vehicles, as indicated with the (B) or dedicated vehicles, just natural gas vehicles with a (D). And bi-fuel vehicles could be just with gasoline, too, so that provides them the advantage of being more flexible if natural gas prices at any point go super high they can still use gasoline, and not lose all the investment.

But what we see in the bottom graph is a side-by-side comparison of a gasoline vehicle -- the same model with a gasoline and natural gas vehicle.

Initial vehicle costs are a little higher (indiscernible) -- fuel costs on a unique basis are much cheaper, much lower for natural gas, seeing a useful life. And the total lifecycle costs, that's significantly lower for a natural gas vehicle.

And that's for one specific model. And then that's the State of Oklahoma purchasing their government cars. So, overall they're thinking they'll be able to save $6.9 million in the lifecycle of these vehicles.

Now, that's for government vehicles.

For trucks it's different, you don't look at lifecycle costs. You look at payback period. And that's because most trucking companies own the vehicle for a short period of time and then they resell them on a secondary market. So, they're interested in recovering their initial investment in a short period of time.

So, not all companies can afford to make the large investment of that LNG truck is, and that's a larger investment than a CNG vehicle is. And so what we think that works is that it's -- it's trucks that have a limited range, even though they're like long-haul transportation, it's companies that operate regionally, because they have a limited range of 400 miles.

However, they have to have a high intensity of use, more than 100,000 miles a year. And then they have to have access to terminal fueling infrastructure because that's an important limiting factor nowadays.

This is an example of a modeling study that we've conducted at UC Davis, and that's for Class 8 trucks. We're comparing different alternative fuels to a conventional diesel.

And we've looked at -- so, we're comparing -- is that better? -- conventional diesel to hybridizing it, which is actually the lowest initial cost. Those are the additional costs of the vehicles.

Then we have LNG, with a spark ignition engine, LNG with a conventional ignition engine, LNG spark ignition hybrid, LNG compression ignition hybrid, and then batteries and fuel trucks.

And what we are calculating is a payback period, and also break even costs. And what we're finding is that it won't work for any kind of company, like I was trying to explain before, it depends on the type of engine, and the driving cycle, and the driving intensity. And given today's -- and those are standard DOE prices, so calculations might change in specific cases.

But given today's assumptions of diesel prices of $4 a gallon, and LNG prices of $2.923 on a diesel gallon equivalent basis, you only -- for long-haul drives, long-haul trucks that are heavily used will have -- will be -- it will make sense for a company to do that and will get a payback period of three years.

So, we think, and this is actually showing projections from different consulting and industry group, and we think the adoption rate is going to be slow in the next few years. Something like 5 to 10 percent of new vehicle sales of the Class 8 truck vehicles will be natural gas vehicles.

But a faster adoption rate might occur in the next few years. Some think it could be as fast as 40 or 50 percent of new vehicle sales.

So, this map is showing heavy traffic truck corridors. And we're interested in California, and California is a heavy traffic zone, so I think we would see that happening here.

So, now I'm moving to the last part of the talk, which is the effects on greenhouse gas emissions and what are the key assumptions for our results.

This modeling study for Class 8 truck engines and that's measured -- that's compare different alternative fuel engine technologies for Class 8 trucks is measured CO2 emissions. It's measuring only tailpipe emissions.

And we find that natural gas trucks, natural gas engine for Class 8 trucks can drop CO2 emissions to an 80 percent of a conventional diesel vehicle.

And, actually, the emissions -- the reduction in emissions might be more significant than just hybridizing a diesel truck, which is not as effective.

But now that was just tailpipe emissions by comparing different type of engine technologies for Class 8 trucks.

Now, this is another study. We're building scenarios for the entire heavy duty sector. And we have several assumptions of fuel usage, fuel substitution and technology adoption rates that I pull up here. I'm not going to explain them because this is like the thesis of one of our students. And I have the source at the end of my presentation, and the link where you can download, if anyone is interested in the details.

But what I want to show you is that this is projecting a progressive reduction of gasoline and diesel used, and more CNG and LNG, and hybridization, so these will be a reduction in fuel.

And also, we assumed there's going to be more, increasingly the use of low carbon fuels, and that includes biogas.

And the results of these scenarios is -- and we're also measuring not only tailpipe emissions, but lifecycle emissions, and not only CO2 emissions, but every criterion pollutant and also other greenhouse gas emissions.

So, the result is that in this scenario, compared to the baseline scenario which is what we're doing today, we have significant reductions on CO2 emissions, methane emissions, and Sox.

And we have significant increases in N2O and non-methane hydrocarbons.

Now, in terms of lifecycle segments that contribute to these emissions, we see that tailpipe emissions are half as much as in the baseline scenario. And if we have a higher penetration of natural gas vehicles, and in terms of upstream emissions we have much less CO2 emissions in this scenario because of these hybridization and these adoption of low carbon fuels.

Another part of this project is studying the social costs of these -- of adopting this, and that includes costs of air pollution, climate change, noise, et cetera.

And what this is showing is the alternative fuel scenario, which is the scenario that I just described, it has a lower social cost, it's in green here, than the baseline, the reference scenario and another scenario, the high-efficiency scenario that we considered in this model.

So, I was told to try to keep it real and less academic, but there's a lot of research, issues that are a little bit in the realm of academia right now. But are little by little trickling into actual results and some of them are -- we're using more of a consequential LCA analyses than attributional and that's integrated in direct effects.

That's like what we've heard before about biofuels and the land use changes. Or for natural gas, it occurs to me, it's for fracking we're using more water and that's like an indirect effect, for example.

And we also are incorporating in our analyses of overall greenhouse gas emissions, their bound effect. And that's true for any alternative fuel. Creating more alternative fuels, even if they're like low carbon, might increase overall carbon emissions and that's because you're making the conventional fuels available in other markets at a lower price, and that incentivizes the use of those high carbon fuels elsewhere, so globally you have a net increase.

Also, the time rise on your use to calculate the global warming potential effect, the weights when you convert equivalences in CO2 equivalent.

And other broader social economic aspects that we need to take into account, like the fact that there's lots of venting and flaring nowadays in gas production because the price is low.

If there was demand for this natural gas, maybe they would care to capture it and sell it.

And also, of course, regulation, we could always regulate that.

And there's new green completions that are probably coming in place soon, and we'll see that, that will change.

So with this I would like to finish. And those are some of the works that I've described. I have our server here. We have lots of these reports that are publicly available.

We also have Professor Amy Jaffe's faculty page. We have lots of her reports there.

And there's my contact information if you have any questions.

COMMISSIONER SCOTT: I do have one question and I recognize that it probably, actually could warrant quite a bit of discussion, and so maybe just give me an overview point and then I could follow up later.

But on page, slide 7 you mentioned during the price forecasts that your estimation is that the prices will stay more steady. What were some of the reasons for that?

MS. DOMINGUEZ-FAUS: The reason is that we have really a lot of supply and that there will be -- we're trying to create this demand, but that's going to take time before we can create this demand. And at this time it buys us time for the current investment in innovation to produce better technologies that would lower the costs and, therefore, reveal even more resources at a lower price.

COMMISSIONER SCOTT: That's a good, succinct answer.

Jim or Hazel, questions?

MR. BARTRIDGE: No questions.

COMMISSIONER SCOTT: Okay, thank you.

MR. OLSON: Okay, moving on to our next speaker, we've invited Tim Carmichael with the California Natural Gas Vehicle Coalition to talk about some of the other aspects of natural gas vehicles, and some discussion of where we think we're going in terms of projections.

MR. CARMICHAEL: Thank you very much, Tim, Commissioner Scott, and the rest of the CEC staff. It's a pleasure to be here, glad to be part of this workshop.

Let me start by saying that I drove here in my natural gas Civic. And if you could pass on to Commissioner McAllister, it's not about the guilt. It's about inspiring him, all right.

So, with that let me start by sharing a little bit about who I represent. This, you know, capture of logos I think is a good way to show you who's on my board of directors. It's a mix of companies that sell fuel for transportation purposes, companies that build vehicles, and companies that use natural gas in their fleets.

We've heard this -- I think everyone in the room has heard some version of this recently. It's just a short list of all the wonderful things about natural gas, which you can study later.

It wouldn't be right for me to be up here and not do a brief advertisement for some of my members, especially since things have changed in a positive way with the availability of natural gas vehicles.

These are some of the light duty natural gas vehicles that you can get today. The pickup trucks, which I think a couple people have mentioned today, are dual-fuel and the Civic is dedicated natural gas.

There's also, I represent some companies that are converters or up-fitters, and they get new vehicles from GM, Ford, for example, and these are some of the examples of the medium duty vehicles.

I think Philip Sheehy mentioned this, this morning, this is a sector -- it's a little bit difficult to predict what's going to happen in this sector because there's a lot of options available to them, and they all have different duty cycles depending on your fleet.

But for example, AT&T and Verizon are buying thousands of natural gas service vans because here in California not only do they get the lower fuel price, they get HOV line access. And that helps them on their service time.

So, you shouldn't have to wait as long for that AT&T installation next time. That was a joke.

So, let me just see, yeah a couple of things I want to mention that -- let me go back one slide.

One of the things that we have been working on with these companies is ARB's conversion certification program. That's the process you have to go through if you want to get approval to sell a conversion kit for your fuel in California, whether it's a new vehicle up-fit, or an end use or used vehicle.

And over the last year and a half we've made a lot of progress in discussions with ARB and I'm pretty confident that this fall they're going to update their regulations in a very positive way that will make it easier for companies; easier as in shorter time period and lower cost.

So you'll see, I hope, not only more product availability, but lower cost for these up-fits.

Moving on to heavy duty, a wide variety -- and Tim also knows this pretty well because of the tardiness to my presentation. But a lot of people were sending me information for input to share with you today.

There has been -- as Rosa showed in one of her slides, there's been a lot of work done over the last year, 18 months, looking at natural gas, and everyone's got their theories on what's going to happen over the next 5 to 20 years.

So, we also did some of this work as an organization. The numbers -- that first estimate I compiled from data from gas utilities around the State and my members.

I'm intentionally not giving you a breakdown by company because they don't want you to know that. But this is a good estimate, we think, of what happened in 2012, at least it's our best estimate at this time.

The next set of numbers is projections that we developed earlier this year, late last year with our membership. You know, feeding off of the National Petroleum Council's work last summer, which was looking at national projections, we used California population as a surrogate to estimate, you know, the percentage of those national projections that were likely on the State level.

We looked at work that the CEC has done, going back to 2007 looking at natural gas projections, and we came up with these three scenarios.

This is what feed into -- at least one of the data sources that fed into the work that ICF did on low carbon fuels that Philip Sheehy started the day with in presenting to this group.

Let me say that there is a lot of debate among my membership as to what is -- which one of these numbers is right and, even more importantly, what's the likely split between CNG and LNG, compressed natural gas versus liquefied natural gas.

Today, in California, it's about 90 percent CNG, 10 percent LNG.

I have members that are very confident that it's going to be about a 50/50 split in 2020 and I've got members that believe it's going to be the reverse of what it is today, and 90 percent LNG, 10 percent CNG in 2020.

There are good arguments, you know, supporting those different perspectives. And I'm happy to talk to people that want to get into more details after today.

A couple of highlights of the research that we pulled from for today, the National Petroleum Council is talking about 40 percent, or just under 40 percent heavy duty trucks by 2020 could be natural gas and as much as 50 percent of the market by 2040.

ACT Research, about a third of the fleet in 2020, and these are national projections.

And in CD Energy's report about 25 percent.

In addition to these, I have reports from my members, talking to truck and engine OEMs, who are talking about a little bit more conservative numbers of 20 percent of the market in 2020. Twenty percent of the heavy duty market in 2020 being natural gas.

And, typically, at least their estimates these days are 50/50 split between CNG and LNG.

A couple other numbers I want to keep your head spinning with is the number of natural gas vehicles in the country, somewhere between 120 and 150 thousand, the number in California, we think between 25 and 30 thousand.

The numbers globally are now up to -- well, it depends on whose numbers you believe, but in the range of 14 or 15 million vehicles, and there are now projections that we could have as many as 35 million natural gas vehicles globally by 2020.

As the staff has heard me say before, this is an unusual situation with natural gas compared to other alternative fuels in that California is not on the leading edge of deployment of this fuel compared to the rest of the world.

We can argue for all the other fuels and technologies we probably are. In natural gas, I submit we're lagging a bit.

Also, these percentages are more helpful if you know roughly where the market is for trucks on an annual basis. And I think a good number right now is about 225,000 Class 7 and Class 8 trucks.

And I'm going to show a slide on this in a minute that will give you a bit more detail. Yeah, I think that's good for now.

So, let's see, I included this slide just because it's interesting to note that there are -- hang on a second, I might have skipped a slide, let me just see. No. Well, maybe I shuffled a slide.

This is a forecast just showing, you know, significant growth and that's the one thing that's consistent between all of these projections that I'm sharing, whether it's the OEM's more conservative, or these various groups that were brought together to do an analysis, they're all showing significant growth. As much as -- you know, and there's quite a bit of consistency in the five-year projections of 50 percent growth over time -- growth rate over time.

This is from ACT Research just showing what they think's going to happen with Class 8, which is the heaviest duty, on-highway natural gas trucks.

At the bottom there you can see the sales per year and then the cumulative sales.

Another number slide for you, a couple of things I'd like to point out on this one. So, there's significant ramp up -- I'm not sure which slides you guys are looking at, or projectors.

But here -- oh, total sales, trucks and bus going up significantly. They get to 35 percent in 2020.

But I also want to point out that there's much higher penetration already in the refuse. We're at 50 percent of the market. And in transit we're at 50 percent.

Transit's going to go up to about two-thirds is what people are predicting, but refuse is on a trajectory to be 95 percent in the next few years.

It's a smaller market, but they're finding great success running on natural gas.

I also want to point out, for those in State government, the municipal fleet numbers are at a faster growth rate. And I think there's two reasons for this, one is there's a lot of pressure on local and State governments to save money in their operations, so the fuel cost is a big deal.

But there's also the benefit that most of those State and local fleets are essentially fueled and they are coming back to the same base every night, in most cases.

Infrastructure, I just want to -- you know, Tim asked me to cover this as well, a little bit. I broke it down into big, medium and home. And big, if you -- definitely if you're looking at the trade journals, but even if you're looking at *The New York Times, The Washington Post*, or *The L.A. Times*, you're seeing news announcements every few weeks about some big deal with a natural gas provider and some operator, whether they're operating truck stops, or they're operating a fleet.

All of these companies on the top list there, in the big, not only are they partnership with stations, you know, whether it's LNG for freeway corridors, or within metropolitan areas to service a regional fleet, they're partnership with some of the biggest companies, whether it's UPS, or Frito-Lay, PepsiCo, or some of the others, and building stations where those fleets want the stations across the country.

That's a significant shift from where we were just a few years ago.

The other thing that's not on this slide, there are more than 40 companies across the country right now building natural gas stations.

Some of my -- some of the vehicle OEMs and some of my members are concerned about are we going to have enough infrastructure.

Today you're looking at a lot of activity, a lot of availability of funding to build natural gas refueling infrastructure.

I believe that's going to continue for the foreseeable future.

In the medium duty, I just want to mention that whether it's the AM/PM, or Circle K that you might buy your gas at, there are a number of companies that are targeting that market, where they're going in with a system that some people refer to as CNG in a box. Where it's a unit they bring in, they put it on your site, and they can offer natural gas refueling at that location.

Other companies are, you know, installing single pumps or two pumps at these gasoline and diesel stations.

In some cases, I've got a company I'm talking to that's putting in refueling, natural gas refueling pumps at shopping malls, targeting that, you know, location.

And then, you know, on the smaller, for the passenger vehicle for you and me, there's significant potential here.

There isn't a lot of that product availability in the market today, but DOE put out a solicitation more than a year ago now. At least half a dozen companies got a chunk of that and they're tasked with, you know, developing the next generation of home refueling; high durability, low cost.

And that could be a game changer in the light duty market going forward.

Tim and staff asked us for key factors for NGV penetration over the next seven years. The fuel price spread, which a few people have talked about, is the most significant. It's definitely giving natural gas a competitive advantage today.

But there's also, you know, the question about truck and engine availability.

In the heavy duty -- I'll cover this in a minute, in more depth. But in the heavy duty market you've got a lot more availability than you had six years ago, but you don't have as much as some fleets would like.

The question I mentioned about availability of infrastructure, improving, expanding, you know, rapidly, but not as widespread as petroleum for sure.

Engine costs, we're all going lower with emissions targets in the next generation engines. The question is what's the cost on those engines going to be and how competitive are they going to be with diesel or other fuels.

And then availability of incentives is a big piece. You know, $12 million may not seem like a lot of money to the Energy Commission anymore, but in the natural gas world it's one of the biggest pots available in the country for natural gas incentives.

And, you know, every time I saw that people are surprised by that. But that's where we are as far as incentives for natural gas transportation.

The CEC AB 118 money is one of the biggest pots in the country so we cherish it.

I thought it would be helpful, I'm sure there's some skeptics in the room, talking about how much progress can we make over the next seven years with natural gas transportation, and the adoption rates, how many vehicles can we actually get on the road, how many stations can we get built?

And I thought it would be interesting to take just a quick look at where we were in 2007 and where we are in 2013. And there's too much to put on one slide.

But quickly, in 2007, one 9-liter natural gas engine available in the Class 7 market. It was being used by the refuse and transit market. Less than 10 percent of the refuse market was natural gas.

One small-volume manufacturer, BAF, converting, you know, taxis, and vans, and shuttle busses to natural gas. There may have been two and I apologize if I've got that wrong, but I think there was just one.

Only one light duty natural gas vehicle available in California, only one small LNG facility in the Western U.S.

In 2013, and I recognize the print's a bit smaller, but there's a lot more.

You know, all of the Class 8 truck manufacturers are offering natural gas trucks today, every transit bus manufacturer and refuse manufacturer.

More than 50 percent of the refuse market is --

or I should say at least 50 percent of the refuse market is natural gas.

We've got at least five small volume manufacturers doing conversions. We've got other major OEMs in the mix with the light duty market.

And we've got a few other things going on that are interesting. All the buzz seems to be about heavy duty trucks, but there's a lot going on in the bigger than heavy duty truck markets as well.

You've got Caterpillar and General Electric, you know, moving aggressively to develop natural gas locomotives.

You've got a lot going on in the marine world, and the mining. And some of you may have seen, British Columbia is starting to run their -- it has a plan to run their ferries on natural gas, other ports around the world, Hong Kong doing the same, Scandinavian countries looking at that or doing that.

And then we've got a couple more LNG production facilities in the west.

So, six years, a lot of change.

Here's a California gloat or California opportunity, depending on your perspective. We are well-positioned to lead on a national level. We have the most infrastructure, proportionally.

I heard a number today that the stations in the State may be as many as 600. But for sure it's more than 400, and that's about a third of the nation.

LNG supplies in-state and nearby, good success stories in various fleet types in the State.

And we have, you know, I'll call it a benefit, though my friends in WSPA won't agree with this, the higher petroleum prices in the State mean natural gas looks even better as a competitive fuel.

That said, it would be fair to say that the Energy Commission is our best State level ally.

The South Coast AQMD is probably our best regional ally.

But beyond your two agencies, there has not been a lot of support for natural gas transportation in the State. I emphasize this because there's a lot of opportunity, I think, for the Administration and for the State as a whole to do more to embrace this fuel.

I commented to a friend earlier on, when Rosa was highlighting the Oklahoma experience, you know, Oklahoma was part of this group of 22 states that put a buying consortium together.

Governor Brown's office was approached on that and took a pass. And I think that's a real pity given how much pressure there is on our Department of General

Services to do more with the State fleet. And electric can't meet all the application needs, so there's more we can do as a State.

Contact information, yeah, a couple of people included the web links to the different resources they used. I neglected to do that. I'm happy to provide those to anybody who contacts me, and I can give that to the staff here, as well.

Thanks very much for the opportunity, again.

MR. OLSON: Thank you, Tim.

So, our last speaker of this session will cover kind of an interesting aspect of natural gas and that's renewable natural gas.

And I'd like to welcome Johannes Escudero, who's the Executive Director of a fairly new association, the Coalition for Renewable Natural Gas.

MR. ESCUDERO: Well, good afternoon, ladies and gentlemen. And I just want to thank and acknowledge Commissioner Scott. And it's good to meet Hazel, and Jim good to see you again.

Tim, thank you for the invitation to -- of our industry that we represent, the Coalition for Renewable Natural Gas.

And briefly, as Tim alluded to, we are a fairly new trade association, a 501(c)(6), who represents a number of developers, engineers, financiers, gas marketers, gas transporters, as well as related law firms and organized labor, and a couple of utilities as well internationally.

We're proud to wear that distinction. We just now, in the last two weeks, welcomed our first international member from Brazil, so we were particularly interested in the topics earlier this afternoon.

But the Coalition was formed in 2011 and our mission focus is the increased utilization and advancement of renewable natural gas.

We're a membership-based organization, very strong focus on public policy, and our success is driven by the relationships that we have and continue to foster.

A brief overview of our presentation today, do not fear, I recognize I'm standing between most of you and dinner, perhaps, so we'll breeze through the 30 slides, of which there are only 27 remaining, in a short amount of time.

I think a couple of definitions will be helpful in terms of understanding renewable natural gas and the different technologies used that are sometimes interchangeable, sometimes not, particularly in light of today's application for transportation fuel.

We'll consider the potential, per Tim's request, give thought to the drivers behind growth and increased use of RNG in California as a transportation fuel. And then provide you kind of two perspectives, one being kind of the idealistic and a second, perhaps a more realistic estimate of available volume of renewable natural gas for a transportation fuel between now and 2020.

And then we'll conclude in a few moments with sharing a few industry insights, challenges that we face and as well as providing some recommended actions for government consideration today.

Biogas is a mixture of hydrocarbons that is a gas at 60 degrees Fahrenheit, at one atmospheric pressure that is produced through the conversion or decomposition of organic matter.

In includes landfill gas from waste digesters, landfills, gas from wastewater treatment facilities.

Waste digesters include digesters that process animal waste, biogenic fog or fats, oils and greases separate from food and yard waste, and also include carp residues.

Waste treatment plants include wastewater treatment facilities and publicly owned treatment works, although, our focus today will be more so on the primarily source of renewable natural gas in California that will come from landfills.

Renewable compressed natural gas is biogas that's processed to the same standards that pipeline natural gas, or biomethane. So to distinguish between biogas and biomethane, biogas generally speaking is the raw methane that's initially captured at a landfill or wastewater treatment facility. When it is treated to meet certain pipeline specifications, the industry refers to that same product, biogas, as biomethane.

And when it conforms to the pipeline standards it becomes renewable compressed natural gas. And there's the metrics here that I won't bore you to death with here.

But it's important to note that only renewable CNG that qualifies as a renewable fuel and is used for transportation fuel purposes can generate a RINs under the current Federal Renewable Fuel Standard Program.

Similarly, there's renewable liquefied natural gas. It's biogas that can be blended in with natural gas to create like RCNG, also RLNG.

And the same caveat applies for RIN qualification under the RFS.

Now, just a brief schematic here from the landfill source, the cleanup and conversion, compression, liquefaction process that biogas from the source undergoes in order to produce the pipeline quality product, biomethane, whether it's used -- most commonly in California, at present, for combustion and the generation of power but, hopefully, on a larger scale moving forward for alternative transportation fuel purposes, as well.

Biomethane versus natural gas, so one of the first questions we often receive when discussing what is renewable natural gas is what's the difference between RNG and fossil fuel natural gas?

The composition is very similar, they share a lot of different -- the trace components, constituents, and the major difference is in the source of the product.

And so kind of the funny one-liner we've used before is it's the difference between what's decaying, is it last night's or last week's tuna sandwich or is it T-Rex?

One being a fossil fuel source of origination, the other being a renewable source.

And in California, by virtue of our population, we have the largest landfills in the nation, we produce the most amount of trash, and so we're hopeful that we can continue to utilize as much of that, capture it, clean it up, put it to good use to the total benefit of both the environment and the economy rather than just flaring and literally wasting the resource that we have here at our disposal in the Golden State.

Potential end uses of renewable natural gas across, well, internationally primarily have been to present for, as I mentioned earlier, electricity generation.

States, like California, recognize the benefit environmentally and afford different levels of content categories where renewable natural gas, if it's used to generate electric power can qualify for RPS credits.

But RNG's also used for thermal heating. And some states, actually allow RNG to double dip, be used for electric power and get RPS credits and, also, if it's used for heating application to local residents can generate AECs, or alternative energy credits under their alternative portfolio standards.

But today we're focused, thus the highlight is the use of RNG for transportation fuels. And in parentheses there you'll note the two primary drivers we'll talk more about later, being the RFS-2, now, and California's LCFS.

Just a quick picture here to kind of summarize, I know the numbers may contradict slightly. Certainly, I would defer to Tim Carmichael, who would know better than we in terms of how many natural gas vehicles there are nationwide, worldwide, and in California.

But the estimates there, as he alluded to, are nearly 16 million worldwide, 250,000 nationwide. And certainly look forward to working closely together to see that number continue to grow.

Potential, the potential growth for renewable natural gas in California, in terms of use for transportation fuel, there's a couple of drivers. There are a couple of drivers that really drive growth and we've kind of labeled them as backseat drivers and designated drivers.

So, I'll give you first the backseat driver, which is the technical data that certainly comes into play and factors in the direction that the industry is going. And it really comes down to two components, and those are the technical engineering and the financial engineering.

For example, one of the largest landfills owned and developed by one of our members, currently, previously had three cases of bankruptcy. And in all three cases, including the current owner and developer, using the exact same technology, just employing different financial engineering, and so these elements are crucial to the success and growth of RNG projects, particularly in California.

And then the designated driver, which we'll conclude with, is public policy, and I think what we're most interested in today.

But the technical data that does drive and influence the potential of RNG generally -- we'll try to give you this in a nutshell, but generally speaking the MMBtu or -- this is -- Btu is a British thermal unit of measurement. This refers here to 1 billion -- MMBtu is 1 billion British thermal units.

So, the MMBtu of gas produced per day, from a landfill for example, factors into how and for what end use purpose an eligible landfill project may be developed.

Smaller landfills, typically, are developed for on-site electric power purposes, for thermal heat application, or to fuel their fleets on the site, like the refuse waste management or public services companies that Tim mentioned earlier.

Raw biogas, depending on the source, is approximately 50 to 55 percent methane content. An on-site fueling station needs to hit a 90 percent target.

And so there's a process there, the diagram we showed earlier, the cleanup, adding, blending different fuels, different requirements depending on the state and regulations.

Larger landfills are usually developed to deliver pipeline quality biomethane for off-site generation of electric power for thermal heat, or utilization as a transportation fuel.

And I might just, as a side note, mention that in California our municipal utilities have been a tremendous ally and customer to developers of renewable natural gas across the nation. They obviously identified the benefits of biomethane and have targeted as one of their top priorities for procurement for the next 20 years. Because they can procure it for a long term, it's under the benefits of the RPS.

At least that was before AB 2196, last year.

But to deliver for off-site transportation fuel, in large quantities, renewable natural gas must meet pipeline specifications.

We mentioned earlier, in some cases there's the heating value requirements, depending on the utility. And every pipeline specification has a cost associated with that, and a rigorous process, and frequent monitoring and testing that accompanies it; which gives us a volumetric ratio that we'll again refer to, shortly, when we present our ideal and realistic estimates for future available volume of the gas.

The second component or aspect of the technical data that serves as a backseat driver to industry growth is the financial engineering piece.

And kind of taking away the secret here from the secret by putting on the slide, but it's really not complicated.

The secret formula that was, for instance, the Dallas project I referred to earlier, the difference between three bankruptcies and a successful project producing very profitable revenues is that revenue must exceed expenses. I'm not an economist by any means, and don't pretend to be.

Value is created in terms of the dollar by governmental organizations, by financial institutions and is largely determined by public trust, or public faith you could say.

In fact, the word "finance" the first syllable, "fi", the root word is faith there. Semper fi is where finance comes from.

So, public trust or faith really does have an important role in the financial engineering of these projects, and you'll see how this ties into public policy.

So, due to the investment, which is literally tens of millions of dollars required, and limitation on access to markets, which we'll talk about shortly, on 39 out of 594 operational landfills in the entire United States have been developed into high B2 projects.

I might note there are zero in California. The exception there is Waste Management's Altamont landfill, which they're currently using a combined cycle to generate electric power on-site, and also fuel their fleet. That would be the exception.

And then there's a wastewater treatment facility, the Point Loma project, which our developers scratch their heads and just wonder how they're making it, and we top our hats to them.

The reality is, the reason why they're able to make it is because they were the recipients of $30 million in grants. So, out of $45 million necessary to develop, $30 million of that has been in grants.

Well, we don't have that luxury on the renewable natural gas development. There are currently, and we'll talk about this again shortly, no Federal subsidies, grants available for development.

This is not true. There are a lot of costs. And for some reason it's -- oh, there it is. Okay, it just required another click.

So, I won't go through each line item, but if you look at the red tally on the bottom, basically this is a dollar figure of what it costs per MMBtu to develop a renewable natural gas project from a landfill.

And if you figure an average of 4,000 MMBtus produced per day, and you can do the calculation later, it's literally tens of millions of dollars.

Keep in mind the secret formula, revenues must exceed expenses predictably.

Well, as of May 2013 the Henry Hub pricing for natural gas is just $4.23. So, the problem here is very evidence that the costs, compared to the cost to develop a high Btu RNG project, $5.48 per MMBtu, the commodity price for the energy content in RNG does not meet the secret formula, you're losing a dollar and a quarter per MMBtu.

Predictable return on investment, the same is true for financiers who invest in RNG projects, as are investors across the board for other projects, they like to know they're getting their money back and like to have a sense of confidence that they can expect some return on their initial investment.

Likewise, owners and developers of these projects also want to make a profit.

And taxpayers like to know that their money is not being flushed down the drain or, in this case, thrown away with the trash.

Let's get to the good news. The good news is now we're talking about public policy as a designated driver. The good news is that we know policy drives demand. For our industry demand drives value. And with good public policy in place the financing we've already gone through can and does work, even with the low current commodity pricing.

The RFS2 creates the RIN market and when you produce renewable fuel, and dedicate that fuel for transportation purposes, you generate a commodity that can be traded or sold on the market as a RIN. There's 11.2 RINs per MMBtu, with a value of anywhere from 30 cents to $1.29 per RIN. This is as of July 16th.

And then on top of that, in California we have the LCFS credits, which are valued at approximately $5.00 per MMBtu.

So, when you factor in all of these extra economic incentives made possible by the RFS, by the LCFS, these projects now are financeable and are doable.

And I will say that the growth of available RNG volume for transportation fuel by 2020 is very much dependent upon the continuation of and certainty provided by a good public policy program, like the

Federal RFS2 and California's own LCFS.

Now, we'll give you a couple of estimates. First, the idealistic estimate of available volume by 2020. Again, referring to our volumetric ratio, for every 1,000 MMBtu, for every 1 million Btus of biomethane produced per day you receive an approximately $7,752 gasoline or diesel gallon equivalents.

So, based on a diesel truck driving an average of 150 miles per day, at 6 miles per gallon, consuming 25 gallons per day, a thousand MMBtu can supply enough fuel each day for 310 trucks.

I might note there are approximately 1 million diesel vehicles operated on California's roadways each year.

And if all 80 operating and candidate landfills in California, identified by the Federal EPA's Landfill Methane Outreach Program, were developed to capture and process methane exclusively for transportation fuel purposes within 18 months or so these 80 landfills could produce approximately 31,008,000 diesel gallon equivalents of renewable natural gas.

That's enough RNG volume estimates to fuel at least 99,200 trucks per day between now and 2020.

For perspective, that's only about 10 percent of the diesel vehicles operating in California today.

So, that’s the ideal, now let’s bring it home to probably closer to where we are.

Our realistic RNG volume estimate, when you consider that there are only 39 high Btu landfill gas-to-energy projects that have been developed in the United States in the last 30 years, and there’s only four in all of Canada, our members came together in a process of a working group and have estimated that, really, it’s closer and likely that only 20 of California’s candidate or operating landfill will be developed for an RNG project used exclusively for transportation fuel purposes.

Let me give you a little background on what constitutes a candidate or operating landfill. An operating landfill is exactly that, it’s a landfill that’s currently in operation, receiving waste in California, with at least 1 million tons of waste in place.

Our members, developers with industry experience, believe that it’s necessary for landfills to have at least 2 million tons of waste in place in order to justify the financing and the output necessary for a high Btu project.

Nonetheless, factoring that in, in the next 18 months or so, assuming that facility construction is necessary, these 20 landfills could still produce, realistically, approximately 465,120 diesel gallon equivalents of renewable natural gas. There's a typo there and the comma is misplaced.

Again, that's enough RNG to fuel approximately 18,600 trucks per day between now and 2020.

Not a large amount. It's low-hanging fruit, though. It's avoiding flaring this product and putting it to good use.

18,000 trucks would fuel Waste Management's entire fleet, for example, and still have some left over.

Of course, this realistic estimate assumes we're talking about a hundred percent RNG fuel blend, when the reality is that RNG can be blended with fossil fuel natural gas to improve the environmental attributes of natural gas and further the realistic estimate of the in-state supply of RNG available for the next number of years.

We're getting close to the end. A couple of industry insights, perspective from the renewable natural gas folks, here are the basic list of key factors that substantiate growth of the industry in California.

How am I doing on time? Are we doing okay?

Good public policy, as we mentioned earlier public policy, good policy drives demand, that demand drives value, value drives investment, and investment is what enables development.

Here are the challenges, so I broke those down in, quickly, three categories that we face in California. There are legislative and regulatory hurdles.

Unintended consequences, I had the privilege of speaking with former Senator Tom Hayden, who authorized the infamous bill in 1988, and it was his exact words that his bill, the intent of his bill was not to create an overarching umbrella to over-regulate and, basically, disable the injection of renewable natural gas from landfills and the natural gas pipelines.

Nonetheless it is what it is. As a result of the Hayden amendment, we have Southern California Gas Company's Rule 30 and PG&E's Rule 21 that effectively prohibit, make it cost-prohibitive to inject landfill gas into the natural gas pipelines.

We're working through that at present at the Public Utilities Commission and their current rulemaking proceeds, compliments to a bill that we support, Assembly Member Agado, AB 1900, that Governor Brown signed in September of last year. Regulations to ensure that renewable natural gas receive treatment and open, nondiscriminatory access to the pipeline will be in place no later than December 31st of this year, by statute, so very happy about that.

Nonetheless, there have been unintended consequences that have been impediments to growth in California. And the irony is a lot of the RNG developers nationwide are based in California, but they've been forced to take their technology and their financing and take it out of state.

For example, the McCommas Bluff Landfill, referenced earlier, one of the largest in Texas, that gas is piped to the Sacramento Municipal Utility District and combusted for electric power.

And here we are sitting in California on a vast resource of our own trash. So, we look forward to keeping work together on those issues.

Also, policy incongruence, and briefly I'll just add that you've got clean air goals in California that contradict the renewable energy goals of the RPS.

For example, Waste Management, Republic Services, other refuse companies that are using on-site, combined cycle engines to generate electric power on-site at their landfills in California, currently, are now considering ceasing all operations and returning to flaring that gas because of increased air district requirements.

So, there’s a conflict there, there’s an incongruence of policy. We’ve got to work together to make sure that our policy goals align.

And then there’s policy uncertainty and unpredictability. Predictability is what investors need in order to provide financing to develop projects that will ensure predictable growth.

As much as we love the RFS, we just commented a week and a half ago, Congress solicited feedback from stakeholders as to proposed changes to the RFS. So, we’ve commented and we’re engaged there. We want the RFS to continue. We want the RFS to be more permanent, we want it to have teeth.

And the same is true for the LCFS. Obviously, the recent court contest raised a lot of questions on people’s mind and this uncertainty really affects the industry and impedes development.

There are also physical limitations. The volumetric considerations we’ve already discussed. The proximity of landfills to pipelines, and that’s relative when you consider the technical and financial hurdles we have to overcome.

In additions to the tens of millions it takes to develop a landfill gas-to-energy project and the expected operations and maintenance there's the interconnection costs.

So, if a landfill is producing enough biogas to warrant justified development of a high Btu project to fuel X number of trucks, well, you also have to consider how far away is the landfill from the nearest pipeline.

If it's a mile, you have to establish and construct a pipeline interconnect.

And to show you how that's relevant here, in terms of being a hurdle, and a financial hurdle at that, our members pay anywhere from $70,000 to $200,000 to create these same kind of pipeline interconnections across the nation, including New York, where the Fresh Kill's Project there, now operated by the New York's Department of Sanitation has been in operation in a very densely metropolitan area for more than 30 years without incident.

But in California, recent quotes by our utilities are anywhere from $1.5 to $3 million per mile. And so you add all that on top of the existing cost and it's prohibitive.

And then there's energy sales and property taxes.

And as I alluded to earlier, there are zero

Federal or State tax credits, grants or subsidies to incentivize development of RNG projects in California.

So, in conclusion a few recommendations for government actions and, again, I'll just read them. I'll refer to our suggestions, rather, I won't bore you with the details. I'll be happy to follow up and will include more detailed attachments in our submission to the docket for this workshop.

But creating a renewable natural gas standard, similar to how the RPS aided development of renewable in electric power, we think a similar RNGS could benefit California's industry development.

Create a State vehicle mandate. As Tim's Power Point showed that we expect State and municipal fleets to increase their procurement of vehicles that are either CNG, LNG or natural gas.

We would add to that a mandate that requires them to procure at least 25 percent of their natural gas fuel from RNG to incentivize development of in-state resources.

Of course, there would be a sales tax exemption, real and person property tax exemption for RNG property, similar to the same exemptions that are available to solar projects, creating a transferrable California tax credit.

Grants for a specified percentage, for example 30 percent of the capital cost of an RNG project, making those payable 60 days after they're online or placed in service, if you will.

A minimum cap and trade, provide some guarantee of debt for financial assistance.

A feed-in tariff, this was used successfully to increase available renewable electric power in California and other states. And I think that would be a good idea to consider here, as we're drafting your Integrated Energy Policy Report.

And lastly, I will pause just to read through this because it is important.

Provide clarification that physical transportation by displacement from biomethane is acceptable for the purpose of using renewable natural gas as a vehicle fuel in California for the Low Carbon Fuel Standard.

This would ensure the implementation of an approved LCFS is consistent with the rules for the Federal EPA's RFS.

With that, I'll leave you with our contact information and one final, shameless plug. We have our conference this December. Get away from the rain, join us on Coronado Island, where we'll be discussing, more in-depth, fuel heat, power and policy applications for RNG.

Thank you for your time.

MR. OLSON: Okay, Commissioner, we have one more presentation.

And we kind of split up the -- we set up a vehicle kind of session here to be a little more cross-cutting, since all the rest of the presentations were more fuels.

And we asked Fred Silver to be part of that. He's a Vice President with CalSTART. We asked him to kind of walk through some of what we refer to as the CalHEAT roadmap for medium-duty, heavy-duty vehicle technology. And so, this is Fred Silver.

MR. SILVER: Thank you, Tim for inviting me here today. And thank you, Lead Commissioner and staff for hanging in here this whole time. And I hope you have the brain space to listen to what I have to say, but I'll do my best to be succinct.

Just to frame the area that I'm going to be talking about, you know, medium and heavy duty trucks, according to CEC data back in 2007, represent about 4 percent of the vehicle population in the State, while about 16 percent of the fuel usage.

And the projections were for a decrease of about

13 percent in the light duty segment, in their fuel usage, while a 35 percent increase in the diesel segment.

As we know, CAFE standards for light duty are doubling by 2025, so just to heighten this interest in this area we're going to see the heavy duty and medium duty segment in fuels, and also greenhouse gases move closer to front and center in the vehicle situation.

So, I just wanted to frame that so you kind of have a perspective of how this fits into your larger portfolio of thinking.

I'm going to talk to you a little bit about this wonderful road map, the outcomes from the road map, and our recommendations going forward, and some questions at the end.

So, some last -- maybe, you should feel free to ask more questions so you won't be holding off the next person.

But what is the Center? The Center was established by the California Energy Commission under PIER Program, for the purpose of accelerating the commercialization of technologies in the medium and heavy duty truck space that will help the State meet its environmental policies.

Okay, and CalSTART has been very good at accelerating technology over the years, so I think we're a great administer of this program and we're very excited to be working with you on it.

I'll get to the chase, first, and then come back to how we got here. But from a CO2, we focused a lot on CO2, but fuel economy follows very similar pathways as the greenhouse gas emissions.

The top red line there reflects business as usual in terms of impact data from the State, in terms of, if you're not aware, by 2050 we're going to see a 225 percent increase in medium and heavy duty truck population. That's quite a challenge to work against in order to decrease the use of fuel so it's quite significant. We need to pay attention to that.

The road map, itself, does provide a plan that will actually get us down to the top of that orange line there in 2050. So, we're able to show very readily a 70 percent reduction, while there's an 80 percent needed against the 1990 levels.

And with a little work with Tim, on the renewable fuels side, we think we could probably get to the 80 percent.

But this is an aggressive plan. It requires some significant investment by the State so if we invest through about 2023 to the 2025 time frame, we should have products that are available and can live on their own in this marketplace. So, it's just different, smart investments that need to be made over the next seven years.

So, what is this technology road map? It's just one of many projects that were funded under the CalHEAT Truck Research Center. It's a set of technologies, about 13 technologies, each of them with staged market milestones leading to introduction by 2020, with a return on investment of about two to four years.

Without getting this return of investment of two to four years, we'll be subsidizing this technology forever.

So, we said let's focus on investing in a plan that gets us to a sustainable return on investment. And that's a big assumption and that's why the investment's need in the next seven years to do that.

We focus on the demonstrations, the R&D and, of course, the things that need to be done between now and 2020 in order to meet 2050, because it takes forever to turn over the truck population in the State of California. That is a long-haul situation.

So, how do we do this? I'll go through this real fast because I'll leave you with the documents, and try to get to the outcomes.

We had three committees, the Technical Advisory Committee, which was made up of senior scientists throughout the country, from all the major truck makers, the truck maker suppliers, Freightliner, Eaton, Allison Transmissions, some of the fuel providers in the State, and others. But these are people who are working on technologies to actually help us move the envelope in the truck space.

An Advisory and Steering Committee, which was co-chaired by the PIER Commissioner here, originally Phil Meisner, if you all remember him, he’s gone but not forgotten.

But Ray Gonzales now does an excellent job of co-chairing that committee with me, and you can see here, in reading in your spare time, the list of great members. You probably know many of them from CARB, the various air quality management districts throughout the State, and various national associations that are expert in the medium and heavy duty subject matter.

And then these are the Technical Advisory Committee members that are the senior scientists. They’re actually on the front line, actually helping produce and commercialize these technologies. And with a little bit of help with the investment, they get to move up their greenhouse gas and environmental improved fuel economy projects into the green zone, versus them kind of falling over to next year, and next year.

So, they were able to be very open with us on this and we aggregated that information. We did not provide details on that in the report.

But what we did is we took the million and a half -- we went ahead and purchased the inventory of a million and a half trucks from Polk database, a nationally recognized organization that manages for the automotive industry the number of vehicles purchased every year.

And we broke them down into seven -- six classes of trucks. As you can see, there's three generic classes there, 7 to 8, 3 vocational work trucks in this automotive class on the bottom. The bottom class, incidentally, we call the donut hole because it looks like the regulators aren't paying much attention in this space.

And because of our work with the regulators recently, we're starting to get them to realize that they were a left out element either in incentives, or some way they kind of weren't paid attention to.

And half of them are fleet owned, so it's not a personal vehicle in that category that we're talking about.

The middle three are work trucks of different types, different VMT levels, different work cycles. Some of them sit on the side of the road all day, some do a lot of travel and do a little bit of work.

And then, of course, the top two classes which a line haul, go coast to coast, and short haul or regional that go throughout the State, or from the port and back to IKEA, up in Bakersfield, and back again.

So, we broke them out and we thought that was important because the technologies really can't -- there's not one size fits all.

And as a friend of us all remember, Jim Boyd, about the silver buckshot is needed here, not a silver bullet. So, the buckshot will cover all of these technologies and we can actually aggregate some of those buckshot and targets into these segments and be smart about our investments in the segments, and move the segments forward instead of just hoping that we move the whole industry forward.

So, here's your million and a half trucks. We have the VIN number for every truck in the State starting in 2010. And we had to work real hard to figure out how to classify them.

But you'll see in this set of charts that about 12 percent of the vehicle population, which is the tractors, over-the-road line haul trucks that go from coast to coast, represent 38 percent of the CO2, okay.

Now, you go down to the smallest class of vehicle where you have 531,000 fleet-owned vehicles, these aren't personal, passenger vehicles, representing 36 percent of the fleet, representing only 12 percent, but still an important number.

So, you can kind of get a sense here of the CO2 impact, where nearly 56 percent is in this track 7 of tractors category and another 50 percent is in the vocational truck market.

The vocational truck market can't be overlook, although some folks say we just need to focus on the big guys. But I think we need to focus on all of them.

This is just another view of that truck population, where the left side of the column is vehicle miles traveled for that fleet, for that particular class.

The bottom represents the population of those trucks.

And the circumference represents the amount of CO2 from that vehicle population in the State.

We also did this by NOx because a lot of our -- we had to address NOx, a big component. And as you know, your sister agency, CARB, is very focused on a low

NOx standard.

So, we have two regions of the State, Central Valley and South Coast, which are extreme nonattainment, with the need to drive ozone down by 95 percent, so we need near zero emission kind of technology when it comes to NOx. So, we wanted to pay attention to that in our road map, and we did address that in our development strategy.

We didn't want to leave that stranded and just focus on fuel economy, so our road map does include the elements to do both, okay, in there.

These are the technologies that we focused on, 19 technologies. We broke them into three different categories, advanced electrification, engine and driveline efficiency, and chassis, body and roadway systems.

The top two major categories we addressed with individual road maps in the report. There is a road map for each of those 14 or 13 top bullets to show you what needs to be done, what kind of investment needs to be made over the next seven years to get us to a two- to four-year payback by 2020, so we don't need to come to the bank anymore and we can meet our 2050 objectives.

Okay, we did also model the bottom six in our modeling work, but we did not have the resources at the time to develop an activity, and we felt there was enough, at least for the moment, momentum moving in that space that we could just model that for the moment and we get the best bang for our buck by focusing on the top 13.

This is an example of a road map. This is for hybrid electric, as an example, and then it goes into pages of description of it.

But each of these windows on the top represent four stages of technology that we need to move the hybrid electrics through in the truck world by 2020, ultimately resulting in a two- to four-year payback, with different functionalities in each of those phases.

And in the bottom the actions that it would take to move from stage one, to stage two, to stage three and to stage four.

And we actually modeled the investment for this, resulting in about, overall for all the 13 technologies, something like about $500 million worth of investment between now and 2020 to do what we need to do by 2050.

Okay, so we still do need AB 118 funds to focus on the heavy duty market segments, otherwise we're not going to make it.

These are the kind of actions that we focused on, studies, R&D, pilot demos, and pre-commercial demos, and deployment incentives.

The AB 118 very focused on the right side. EPIC and PIER a little bit focused on the left side. There's a little bit of a mis-balance on that. I'm going to talk about that on the end.

We also modeled the biofuel and renewable fuel element into our modeling work that you saw, you saw the CO2 reductions. That did include these assumptions. Electricity is doing great. And we do see a lot of papers talking about how we're going to get to much higher amounts in that segment.

Hydrogen is right behind that. As you know, hydrogen in transportation also has a regulation in the State that requires 33 percent renewable, so that's a done deal, so we included that.

We're kind of weak in the space on biofuel additions and I keep pestering Tim to tell me more so I can help figure out how we can knock that number up the next time we kind of do this, so it's a little bit moderate there.

But when we used this assumption, roughly we got about 50 percent of our CO2 reduction from renewable fuels and about 50 percent from technology insertion. So, I think that's important kind of -- we need both. We can't do it with one, without the other.

So, I'm not going to walk through this chart just a lot, but I'll get to this. These are some of the outcomes. We did model. We took those 13 technologies and we aggregated them into six driveline solutions because these technologies sometimes work together, like waste heat recovery and electric accessories you wouldn't buy separately, you'd by them together.

So, we aggregated them into six different driveline strategies and you can see they're different for -- the options are different for each of the truck classes.

There are much fewer options in the line haul truck, which is the OTR truck. We're not going to see pure electric trucks, which is the XEV. That doesn't show in that category. But we will see some mild hybridization in that space.

But while you see in the vocational segments, like Class 3A, which is a vocational truck, there are lots of options there because there are so many duty cycles and opportunities for stop and start to electrify that technology.

So, this blue zone here is basically baseline, but baseline is pretty significant. We didn't assume that it stays the same. It's your super truck technologies. If you follow super truck, the DOE's focused on much more efficient truck technologies, but they're only about 10 or 15 percent more efficient. They're not going to get us there, okay.

We need 200 percent more efficient trucks which our technology advisors say we can do, okay, as we look at the truck as a system basis, not just as an engine.

But so baseline will improve efficiency, but won't get us there, so we need these other elements like new combustion technologies, like opposed piston engines, cam-less engines, advanced turbines and electric drive on the electrification of its fuel cells to overcome the fact that the baseline will improve efficiency, but just won't get us all the way to what the State of California needs done.

This is looking at it on an aggregate basis. And we're back here, again, to what our result is.

You can see again here, by 2050 the tractors over-the-road still represent, that's that second little wave there from the top, in color, the second in lighter blue, it still represents quite a segment of our CO2 emissions, but we've made considerable dents in that as well, as well as everything else. But still, it is right in the forefront of what we need to pay attention to.

So, here are some assumptions that you need to think about. First of all, the road map assumes greater than two times fuel economy improvement standards to be established by NHTSA and EPA. And I've already had four meetings with them on our work from the CEC, thank you. They're thanking -- through me, they're thanking you for funding me.

They've already taken our road map, they've taken our model and they're working with it. I met with them today again here, they're meeting with folks at the Hyatt this morning, so I did get a chance to present and do a deeper dive with them today.

And just reminding them without two times fuel economy we can -- and we all know here, we've probably lost 10 to 15 years of meeting any of our goals.

So, we need aggressive fuel standards in this medium and heavy duty segment to succeed to meet our 2050 goals. Otherwise, there's just not enough investment. There will be evolutionary improvement, but not the revolutionary change that our -- incidentally, our technology advisors say can occur, but they need to be incentivized to do that.

So, that's an important takeaway.

Just in terms of makeup of these different kinds of trucks, growth area, I mean the State of California is doing an outstanding job at employing electrified trucks.

I don't know if you know, two-thirds of all the electric trucks in the State -- in the nation have been fielded here in the State of California through its AB 118 Program, under the Incentive Voucher Program.

So, we're getting all that play here and it's established a growing market. Some folks have actually moved here as a result of that, from Colorado and others, to establish manufacturing plants in the State of California.

So, this is a growth area and we would estimate -- this is purely estimations because these numbers are our best estimates, that by 2050 40 percent of the truck population could be electrified along these elements, pure EVs, plug-in hybrids, dual modes, especially down in the zero emission corridor and the Ports of L.A., hybridization, fuel cell range extended, electrified accessories and electric power takeoff.

So, those kind of elements we can see a very significant amount of our population makeup by 2050 if we invest smartly in the right technologies here. And that is a growth area, it's moving. And thank you to AB 118 that it's able to actually start moving in a commercial sense.

So, other growth areas we're seeing, the hydraulic hybrid market, which is more of a mechanical hybrid, not an electric hybrid, we're going to see some -- we project some growth in that market, as well, especially in the refuse truck sector.

We're not going to displace this wonderful natural gas fuel that's being put in there. There's not enough money to save in terms of natural gas fuel by hybridizing.

But the hydraulics are providing a 5 to 10 percent improved productivity on the number of stops that a refuse truck can make per day.

What does that mean? That means that a refuse truck fleet could use 5 to 10 percent less vehicles. So the payback isn't being necessarily by the fuel, which will be saved from this, but is being made by productivity gains because the fleet doesn't need as many vehicles.

So, we're going to see that mostly in the refuse segment and some heavy delivery.

The space that we need more attention spent on, and we have some great suppliers here in the State of California, we need 15 to 20 percent of our technology to be new combustion technology. We need to get away from the conventional piston engine and move to things like opposed piston engines.

In fact, one of the premier organizations in the nation is located down in San Diego, Achates Power, who has been chosen by the U.S. Army to do their next generation engine because the Army, you know, has the largest fleet of vehicles and fuel economy is right up at the top of their list of issues to solve.

But, yet, we're not getting them to do it here in the State of California.

So, I encourage us to visit this organization and see how we can work with them to 25 percent improvement in fuel economy versus just 10 percent being made by super truck.

CAM-less engine technology, we need to move to the digital age of controlling engines. Right now they're analog controls. We all know what happened when we went from analog to digital in the computer error, and we need to do the same thing with engines.

And there's an opportunity, again, another 25 percent fuel economy gains there.

The company that stands behind that one is called Sturman Engineerin. They're in Colorado. They've worked with Navistar for many years, and they've got now the interest of Wal-Mart to do some work here in the State of California with the ports.

So, these are some new combustion components.

And another company called Brayton, which the CEC is wisely funding under PIER Project, an AB 118 Project, which is a parallel turbine, which can produce simultaneous low NOx, which is what CARB, your sister agency wants.

So, this is an area we think needs more attention to.

And then diminishing growth, a driven -- again, we don't want to indicate that this isn't an important segment. We need Cummins and the engines to continue to improve. Right now that's being driven mostly by the super truck technologies that are rolling out, waste heat recovery which can now electrify your electric auxiliaries and you can downsize the engine in the long term.

So, we see, though, a diminishing return. We have an aggressive plan. If we can get the investment, if we can EPA and NHTSA to line up with two times fuel economy and we continue to make smart investments, we think we can get there. Without that, I think all bets are off.

So, just some final notes here for recommendations. While we need -- this chart, again, points out the fact that 38 percent, maybe 56 percent of the problem is with the over-the-road trucks, none of the agencies are really investing in that space wisely. Everybody's relying on super truck to produce these technologies that could be very readily closeted because the industry standards are created to pull them out of the closet, it's very likely that only a few cherries will be pulled out of that sack.

So, we need a process to help. And the first place to do that is to pull these technologies here. I've already waved my hand and said I'll try and help you partner and do that first in California.

So, the other 50 percent, of course, in those vocational trucks.

So, this here talks about some enabling technologies for Class A trucks. We have an issue with the AB 118, which is interesting, and I'm always told that if they can't really deal with a 40 percent fuel economy gain reduction I can't fund it.

Well, the problem is there are enabling elements to get to the 40 percent, like DC to DC converters, auxiliary drives, waste heat recovery, which each measures 3, 5, 7 percent. When combined together, we can get to the 25, 30 or 40 percent.

But AB 118 and the CEC doesn't seem to be able to understand these enablers that will get you there, and there's no way to fund that other than PIER, and

PIER is very limited on its funding, so it doesn't really have the nice space to address some of these enabling elements in their pot of transportation funds.

So, I wanted to point that out as something that we need to look at that. Is that an unwritten policy? Is that just kind of a cultural issue? Or is that something that's written, cast in concrete that it has to be such an aggregate amount that you -- and what we're getting is we're getting a lot of up-fitters just putting stuff together to make it work, but we're not getting commercial products out there rapidly enough to do that.

So, I bring you to this note here. This comes back to these action items, again.

On the left side, those are the kind of action items, and you can argue where that red line should fit, that EPIC and PIER Fund, maybe about $10 million a year. I don't know if that number's exactly right for transportation.

The right side you've got a very nice $100 million a year, but the right side is focused mostly on pre-commercial and deployment incentives. Very little of that is focused on development.

And I talked about these enabling technologies that need to be commercialized. We need to move that line a little bit to the left, I think. I don't know how to get that message out, other than to speak to the Commissioners here and say can you move the line a little to the left and get a little bit of development funding to enable these technologies so we can commercialize them, aggregate them, and then get you the 40 percent with real manufacturers of real products in the long term.

Here are some other follow-on activities, biofuel, we've thought again in this area, and we were a little concerned that the biofuel adoption rate and interest, other than the electric side, on the natural gas side, and the renewable diesel side.

The fleets just don't know about this stuff. There's not a lot of traction going on in this space. We don't see there's a lot there. And there's a lot of great stuff happening, but nobody's connecting the fleets to the fuel.

We think there's a need to develop what we call kind of an adoption plan as a follow on to make that connection so we can go from 20 percent, which is what we're projecting in the out years, to 30 percent. That would just throw us right into the ability to meet our greenhouse gas goals very nicely.

Vehicle miles traveled, 225 percent growth through 2050. Wow, we're working against a real uphill battle. So, how can we reduce VMT? There are ways to do it. There are ways to look at new regulations, like longer and heavier trucks, which had been kind of forbidden or verboten for a long time.

But there are ways to connect trucks. IT has connected smart trucks.

Technology, there's a company called Peloton who can actually connect trucks through a link. They can link up virtually. The one in the front drives the second one and you can actually save about 20 percent fuel because of the drag savings of the two trailers being connected.

And with the zero emission truck work that's being done in Southern California, and the interest in maybe doing some of this in the Central Valley, we could actually start using some of those connected-truck technologies to refuel.

We need to think outside of the vehicle a little bit. As well, I don't think anybody's paying attention to that, that space.

We think since Class A truck is not getting the attention needed from the State in terms of moving forward, we really think that there's a need for a Center of Excellence for Class A trucks, especially in the San Joaquin Valley. We'd love to lead that effort and work, and commercialize, and specifically focus on fleets that go coast to coast, and further electrify those trucks faster than we otherwise would have been. Because right now, if we wait for super truck, I don't think we're going to get there.

We need to start actually adopting some of that now, deploying it, do some pilot demos and getting the fleets excited about that. Otherwise, we're going to lose five years of waiting in that space.

Since we'd also focus on using natural gas, it's real key to being an enabler for the low NOx solution that's required by the State. Also by using renewable natural gas, which we know is limited, and combining it in a CNG hybrid, we can now maximize the use of that fuel. And we talk about that in our report.

We'll have a report coming out very shortly on hybridizing alternative fuel solutions and it works real well when you use renewable fuels because there's a limited source there and you can maximize your limited use of a valuable resource.

And then the implementation of the road map. We have 66 steps, and the way you'll remember that is because of Route 66 in the State, so you won't forget that there are 66 steps.

We need to implement those steps. We think that it's important that in some way CalHEAT be continued to implement those steps to work with its partners.

So, I'll leave you with that. That might be the truck we come out with, here in this picture, in the Center of Excellence from the State.

And I thank you all for listening to me in this last presentation.

COMMISSIONER SCOTT: Thank you for coming and for that terrific close-out presentation. I think that was great.

I have just one quick clarifying question and I'll save the rest of another time.

But you mentioned that there was a potential for a 225 percent growth in the truck VMT?

MR. SILVER: Yes.

COMMISSIONER SCOTT: Is that under sort of a business-as-usual scenario or what's the -- what is the --

MR. SILVER: IMFACT is there's a State set of data that you create, so I'm not exactly sure how that's computed. Do you know, Tim? IMFACT, are you familiar with that?

MR. OLSON: Yeah, and Mike Waugh here probably knows more about this than I do.

IMFACT is a kind of a predictive model for emissions going forward in the future and is used for mostly criteria pollutants. Is that correct, Mike for -- and they do kind of scenario development of engines, technologies, vehicles.

MR. SILVER: So, we do have a nice solution on the table that we haven't even touched, which is how do we reduce that data?

And we don't have the road space to deal with 225 percent truck growth. Thank you.

MR. OLSON: Very good, so I think we're -- we agreed to have a public comment at the end of this. We're finished with our presentations and maybe in the room, if there are questions in the room or comments in the room?

We do have one comment online, one question online. Is that the phone or just --

MS. KOROSEC: It's Roger Gault.

MR. GAULT: Yes, this is Roger Gault with Truck and Engine Manufacturers Association.

Just, I guess, a quick comment. It seemed like virtually all of the presentations that we heard throughout the day today, that made comparisons and projections regarding primarily alternative fuels, all seemed to gravitate based on the current petroleum pricing structure. Oh, there was a little bit of, you know, influx in some of the presentations.

But I think it should be clear to everybody that as the petroleum usage goes down through driving the alternatives that the petroleum price will go down, at least quite likely will go down.

And so if, in fact, these alternative scenarios are being predicted by price differential, you have to be very careful that you don't end up un-funding or defunding, if you want to call it that, the incentive to do what it is that you're trying to do.

And I'm not suggesting that there's an answer for that, but it's a little bit misleading to talk about, say, the current price disparity between diesel fuel and natural gas as being a long term growth strategy whereby petroleum goes away by 50 percent if, in fact, that 50 percent reduction in petroleum results in a 50 percent reduction in cost because you end up in that price point where natural gas doesn't make sense anymore pretty fast.

Similarly with electric, the electric versus petroleum pricing chart that I remember seeing, where there was a lot of noise in the petroleum side, it gets a lot closer to the electric side as you start taking away that price volume driver.

So, just something to keep in mind as you're looking at different scenarios going forward. It seemed like that's something that was missing from virtually all of the analyses I saw.

MR. OLSON: Roger, this is Tim Olson. Thanks for the comment and I think your point that it was missing -- that's something we want to look into because some of the presenters did present more than one scenario based on low, medium, high petroleum prices.

And I don't -- I just remember one, is the biodiesel, the CBA presentation did note a low petroleum -- actually, it would be a low-price petroleum scenario, where biodiesel has less impact or less market penetration.

MR. GAULT: I think in that case it had low, the low was not much lower than today, it just didn't increase.

MR. OLSON: I think it was below $50-a-barrel oil.

MR. GAULT: Oh, was it. I didn't remember seeing that one.

MR. OLSON: Yeah. Another point to make, historically, the Energy Commission's fuel price forecasts have shown, and we think that this is going to be true in this next round here, as we finish this work over the next month, that we see a definite decline in gasoline consumption over time, and we see increase in demand for diesel, at least 1 to 2 percent per year.

The price of petroleum, as you know, the international commodity price has not a lot of control in this State government or this country in that until we have more supply.

And whereas there's a comparison, Rosa Dominguez-Faus' presentation, when you look at the background paper you'll see natural gas pricing in North America is different than Japan, Europe, most other continental pricing. And that differential is something that's unique to North America.

So, that's why we're kind of -- we're looking at this, trying to hedge this and look at how long will that natural gas, moderately low natural gas price be in effect compared to petroleum prices. And, of course, it's compared to high, medium and low.

And you're right, it needs a lot more kind of analysis. The dimensions of those comparisons need to be looked at carefully.

Appreciate your comment.

MR. GAULT: Thank you.

MR. OLSON: Any other comments in the room here or online?

So, that's it. We had lots of information and a definite fire hose today of data and information coming in.

Just again, to repeat, August 9th is our deadline for comments due to us on this workshop. Of course, the Transportation Section, we have another workshop on August 21st and, hopefully, we'll have information gathered today, considered and included in our analysis for that Transportation Section.

COMMISSIONER SCOTT: Absolutely. And before we close can I just add a thanks to Tim and his team for putting together for us what was, I thought, a robust, a really robust set of thought-provoking presentations. It was an ambitious agenda, but we're only about 15, 20 minutes behind, which is kind of where we were all day.

And so, you know, I appreciate the hardy band of folks who are still here in the room, and on the phone, and much appreciation to Tim and his team for putting such a terrific agenda together.

And to Suzanne and Lynette for always helping us have such terrific workshops.

And I just wanted to say, you know, we're thinking a lot about how to transform our Transportation Sector to help achieve our clean air and public health goals, to help achieve our climate goals, and to increase the secure sources of energy.

And it’s pretty heartening for me to see and hear kind of the theme throughout the day of the various growth scenarios of the alternative fuels, the alternative vehicles that are going to help us to get there.

And I would just add one reminder to folks that if you have questions, because we didn’t have a lot of time for questions, Tim has graciously volunteered to help folks find answers, and so you could e-mail those to him and second his call for good comments, because we heard a lot of really great ideas around the room today.

And so I hope that you will get them in writing to us by August 9th.

That’s all, thank you everyone for being here. It was a good day.

(Thereupon, the Workshop was adjourned at 4:55 p.m.)

--oOo--