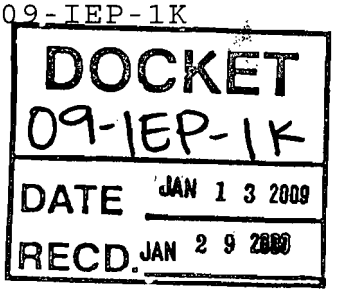
JOINT COMMITTEE WORKSHOP

BEFORE THE

CALIFORNIA ENERGY RESOURCES CONSERVATION

AND DEVELOPMENT COMMISSION

In the Matter of:	)	
	)	
Preparation of the 2009 Integrated Energy Policy Report	)	Docket No. 09-IEP-1K
	)	



CALIFORNIA ENERGY COMMISSION

HEARING ROOM A

1516 NINTH STREET

SACRAMENTO, CALIFORNIA

TUESDAY, JANUARY 13, 2009

9:00 A.M.

ORIGINAL

Reported by:
Ramona Cota
Contract No. 150-07-001

COMMISSIONERS PRESENT

James D. Boyd, Vice Chairman
Presiding Member, Transportation Committee
and Associate Member, Integrated Energy Policy
Report Committee

Karen Douglas, Associate Member, Transportation
Committee

ADVISORS PRESENT

Kelly Birkinshaw, Advisor to Commissioner Boyd

Susan Brown, Advisor to Commissioner Boyd

Diana Schwyzer, Advisor to Commissioner Douglas

STAFF and CONTRACTORS PRESENT

Suzanne Korosec

Ken Koyama

Jim McKinney

Darren Nguyen

Donna Parrow

Michael Smith

Valentino Tiangco, PhD

PANELISTS PRESENT

Bob Fletcher, California Air Resources Board
(CARB)

Paul N. Argyropoulos, United States Environmental
Protection Agency (US EPA) (via telephone)

Fernando Bert$n, California Integrated Waste
Management Board (CIWMB)

Steve Shaffer

PANELISTS PRESENT (CONTINUED)

Steve Kaffka, PhD, University of California, Davis (UC Davis)

Alex Schroeder, Western Governors Association (WGA)

J. Alan Weber, National Biodiesel Board (NBB) (via telephone)

Don Stevens, PhD, Pacific Northwest National Laboratory (PNNL) (via telephone)

John Scahill, United States Department of Energy (US DOE) (via telephone)

Bryan M. Jenkins, PhD, University of California, Davis (UC Davis)

Harvey Blanch, PhD, Joint Bioenergy Institute (JBEI)

Susan Jenkins, PhD, Energy Biosciences Institute (EBI)

Tom Jacob, DuPont

ALSO PRESENT

Chuck White, Waste Management

Fred Wellons (via telephone)

Joe Sparano, Western States Petroleum Association

Greg Shipley, Bioenergy Development (via telephone)

Rain, Source One Records (via telephone)

Sharon Shoemaker, PhD, University of California, Davis

Jeff McElvaney, Proterra Bio

David R. Rubenstein, California Ethanol + Power

Matthew Frome, Solazyme, Inc.

I N D E X

I N D E X

P R O C E E D I N G S

9:08 a.m.

MS. KOROSEC: Good morning. Let's go ahead and get started. Today's workshop is a joint workshop being conducted by the Energy Commission's Transportation and Integrated Energy Policy Report Committees.

I am Suzanne Korosec. I am the Commission's lead for the Integrated Energy Policy Report. I April 2006 Governor Schwarzenegger signed Executive Order S-06-06 which outlined the benefits of bioenergy for California and set targets to increase the production and use of bioenergy in the state.

The Executive Order also requires the Energy Commission to report to the Governor and the Legislature through our biennial Integrated Energy Policy Report on the progress that has been made in achieving the sustainable biomass development in California.

This workshop is going to focus on the biofuels component of the state's bioenergy goals and we intend to hold a separate workshop later in the year on bioenergy production and use for the electricity and natural gas sectors as part of the

development of the Integrated Energy Policy Report.

So just a few housekeeping items before we move to the technical subject matter. Restrooms are out the double doors and to your left. There's a snack room on the second floor at the top of the stairs in the atrium under the white awning. And if there is any kind of emergency and we need to evacuate the building please follow the staff out the doors to the park, kitty-corner to the building, and wait there for an all-clear signal.

Today's workshop is being broadcast through our WebEx conferencing system and instructions on how to participate are contained in the workshop notice, which is posted on our website and also out on the table in the foyer. And the workshop is also being webcast.

For parties in the room who wish to speak during the public comment period, which I believe is identified on the agenda as Company Presentations, we ask that you please fill out a blue card with your name and affiliation. And you can give those to Donna Parrow who is over here next to the WebEx operator. Blank cards are

available on the table out in the foyer.

We ask if you wish to make a company presentation if you would please note that in the upper right hand corner of your card. All others, you don't need to put anything special on your card other than your name and your affiliation.

When you do come up to speak if you could provide a business card to the court reporter so that she can make sure that your name is spelled correctly in the transcript that would really be very helpful.

And we are also asking that because of the number of parties that we have here today if you could limit your comment time to five minutes so that everybody has an opportunity to speak.

And with that I will turn it over to Commissioner Boyd and Commissioner Douglas to make opening remarks.

PRESIDING MEMBER BOYD: Thank you, Suzanne. We it's indeed my pleasure to welcome you to this workshop on biofuels, as Suzanne has indicated. As she indicated I am Jim Boyd, the Presiding Member of the Energy Commission's Transportation Policy Committee and Associate Member of the Commission's 2009 Integrated Energy

Policy Report. I also happen to chair the administration's bioenergy working group so this is a topic of great interest to not only this agency but to me in particular.

The working group that I mentioned includes all those state agencies with important biomass roles and responsibilities. And as I look around the room I see many members of that group who are with us here today.

I am joined at the podium here, or at the table I should say. I'm used to sitting at the podium but this is a workshop. We are trying to keep it a little more open, informal and not intimidating. I am joined on my left by Commissioner Karen Douglas who is the Associate Member of the Transportation Committee. Commissioner Jeffrey Byron, the other member of the Integrated Energy Policy Report Committee unfortunately was unable to be here today.

The purpose of the workshop, as indicated in the Notice -- I should say the purposes are many. There is certainly the indication that Suzanne gave and that the Notice gave, i.e., to evaluate our state's progress in achieving the Governor's very ambitious biofuels

goals.

But in addition the CEC is working to implement Assembly Bill 118, which is to finance activities to carry the goals of the alternative fuels plan of the state of California which was jointly developed by the Air Resources Board and the Energy Commission.

The Air Resources Board is working to implement its Low-Carbon Fuel Standard as directed by the Governor. The Energy Commission continues its work under its Integrated Energy Policy Reports to pursue these goals in the Integrated Energy Policy Reports of the past so we are extremely interested in this topic. And it is one of great interest to lots of communities and organizations throughout the state if not throughout the nation.

We are really interested in hearing from the invited speakers and those of you who are interested stakeholders who sign up to speak later in the day and we welcome you to do just that. We are interested in the technical, economic and market issues that are influencing the subject and that may be influencing progress or lack thereof on this topic.

As Suzanne indicated it was almost two-and-a-half years ago that the Governor signed the Executive Order in question urging state agencies to expand the use of biofuels, both to reduce our dependance on petroleum, and frankly, in an effort to address climate change. Particularly at that moment to combat volatile gasoline and diesel prices. And I don't have to say anything about petroleum price volatility since that date and time two-and-a-half years ago, you have all ridden that issue up and down for quite some time now.

At the time in 2006 the Governor did approve this Executive Order he said, quote:

> "Turning waste products into energy is good for the economy, local job creation and the environment."

Close quote. And that is certainly a true statement of fact for what faces us today. As I said, he challenged the state agencies that comprise the bioenergy working group to undertake a series of specific actions, establish milestones, to promote sustainable biomass development in California.

So that kind of followed on the Energy

Commission's 2005 Integrated Energy Policy Report and then was amplified again subsequently in the 2007 Integrated Energy Policy Report, underscoring the significance of harnessing California's resource stream. Some people call it a waste stream. Urban forestry and agricultural residues, as a source of biopower, biogas, biofuels, et cetera.

It's safe to say that now that climate change has become the major policy driver for concerted action in our state the pursuit of renewable fuel sources, especially biofuels produced from California's waste streams, has taken on certainly added and even greater importance.

And I would note that the Governor's Order establishing the Low Carbon Fuel Standard further recognized the potential contribution of quote, second generation, unquote, biofuels in reducing the carbon intensity of California's transportation fuel supply.

So for all those reasons we are here today to talk about the subject. And although we feel progress has been made we want to hear more about that. The promise of second generation

biofuels is dangled out there as something that will move everything forward, yet we need to get a better handle on what that really means in terms of progress.

We feel more needs to be done to ensure that biofuels are produced and used in California in a sustainable and environmentally acceptable manner. That reflects the goals of many of the documents produced by this agency and the Biofuels Energy Action Plan that multiple agencies helped produce.

So with that I again thank you all for being here, welcome you. I look forward to a productive and educational day. And I will turn the microphone over to Commissioner Douglas before we get to our first panel for the day. Commissioner.

ASSOCIATE MEMBER DOUGLAS: Thank you, Commissioner Boyd. Good morning, everybody. As Commissioner Boyd noted I am the Associate Member on the Transportation Committee. And the Transportation Committee is working very hard with staff on AB 118 implementation, which gives us the goal of using this funding stream to help transform California's fuel and vehicle types.

Under the statute we are trying to achieve a mix of goals. We are trying -- The statute tells us to support California's climate policy, maintain or ideally as much as possible improve air quality, reduce petroleum use, provide economic benefits to the state, and meet and set and attain sustainability goals that can be looked at both in terms of for a specific project and also more broadly in terms of the state's future strategies for transportation fuel and vehicles.

So we are coming into this workshop from a place in which we have been spending a lot of time on these issues and hearing from a lot of people. I am really looking forward to this specific workshop on biofuels and to hearing from the people who will be both testifying and providing public comment later.

So anyway, thank you all for being here. I am definitely looking forward to this workshop.

PRESIDING MEMBER BOYD: Thank you, Commissioner Douglas. And I guess we are ready to move to the first subject matter area, which on your collective agendas is policy drivers. On that topic Susan Brown is going to moderate a panel consisting of Mike Smith of the Energy

Commission, Bob Fletcher from the Air Resources Board. Or maybe Susan I should let you introduce your panel, I know you have done this work.

(Laughter)

PRESIDING MEMBER BOYD: I'll turn it over to Susan Brown to introduce the subject, the panel members and to moderate the discussion. Sit back and relax and enjoy it.

ADVISOR BROWN: Thank you, Commissioner Boyd. My name is Susan Brown and I am here today in two capacities. First I am Commissioner Boyd's senior policy advisor, and second, I am also the lead senior staff for the bioenergy interagency working group, which has been meeting for about two years. And I am pleased to welcome many of our members, some of whom are on my first panel.

As Commissioner Boyd indicated in his introductory remarks, there are multiple policy drivers here in California that support the sustainable development of biofuels in California from California's many waste streams. We are pleased today to have representatives from the Energy Commission, the Air Board, the Integrated Waste Management Board, and by WebEx we will invite a representative of the US Environmental

Protection Agency to speak to us this morning.

So the topic of the first panel is policy drivers and we posed a number of questions to our speakers. What we are about today is to get a sense from the speakers and from the participants in the workshop on the progress being made in reaching the Governor's biofuels production and use goals.

And we would also like to get a sense from the speakers on what market, economic and regulatory barriers may still remain that we need to take notice of. To the extent that we can formulate specific recommendations that can be included in our Integrated Energy Policy Report and be sent back to the bioenergy working group for further discussion and activity, that would be to me the most desired outcome.

I am not going to belabor this by extending my remarks but I do want to make a couple of other announcements. We have five speakers on the first panel. Mike Smith will be speaking to us first and he is the deputy director for transportation for the Energy Commission. And he will be putting biofuels in the context of the Alternative Fuels Plan and Assembly Bill 118,

which is a massive incentive program that was established by legislation in 2007.

Next we are happy to have Bob Fletcher, who is the stationary source division chief for the California Air Resources Board. And his division and staff are busily working on completing the rulemaking for the Low-Carbon Fuel Standard. Which, as you will hear from Bob, will also have a tremendous impact on biofuels development in California.

Our third speaker will be Paul, and I'm going to blow your name, Paul, Argyropoulos from US EPA. He works in the office of mobile emissions, I believe. And Paul, are you with us by WebEx and by phone?

MR. NGUYEN: He's muted.

ADVISOR BROWN: He's muted but he is with us. Next we will have Fernando Bert$n who is the manager of research and applied technology for the Waste Board.

And the last speaker, the clean-up speaker, Val, is Valentino Tiangco, who is our senior lead in the PIER renewables programs. And he is our resident expert on biomass and biofuels.

I also want to recognize Ken Koyama. If

you will raise your hand, Ken. Ken has had the responsibility for pulling together this workshop. So many of the speakers who are here today are largely as a result of his efforts.

So with that I am going to introduce Mike Smith.

MR. SMITH: Thank you very much, Commissioners. It's a pleasure to be here this morning. What I want to do is talk briefly about some of the policy issues, the policy drivers as the agenda reads, here at the Energy Commission on alternative fuels. Starting with the Alternative Fuels Plan and leading very quickly into the Alternative and Renewable Fuel and Vehicle Technology Program, which is where we are spending a great deal of our time at this point.

I won't belabor a number of these points since Commissioner Boyd very eloquently described some of the policy, historical policy, in the opening remarks. But just suffice to say that back in 2003 the Energy Commission and the Air Resources Board produced a strategy to reduce petroleum dependance.

We came up with some rather aggressive goals for reducing petroleum dependance and

increasing the amount of alternative fuels in California. And those were later adopted in the 2003 Integrated Energy Policy Report.

Later, as you said, the Governor, we developed the Bioenergy Action Plan and the Governor subsequently issued an Executive Order which included some production goal targets, in-state production goal targets.

(Some telephone line interference was heard.)

MR. SMITH: Which included some in-state production goal targets for bioenergy in California starting with 2020 -- excuse me, 20 percent of the fuels used we would produce in California by 2010, 40 percent by 2020 and 75 percent by 2050.

Following that the Energy Commission and the Air Resources Board were tasked through AB 1007 to produce the State Alternative Fuels Plan. Essentially what this document did, which we adopted, we jointly adopted in December of '07.

It's essentially a plan to increase the amount of alternative fuels in California. It does so on a full fuel cycle basis. And this is really a very important aspect because this is now

becoming sort of the common thread through all the work that we do related to alternative fuels, both here at the Energy Commission and at the Air Resources Board.

The statute also asked us to establish goals for the use of alternative fuels in California in 2012, 2017 and 2022. And it directed us to establish this plan and at the same time optimize environmental and public health benefits, minimize economic costs and maximize economic benefits to the state.

And just very quickly some of the key findings that we produced in the document. We showed that we could meet the petroleum reduction goals that we established back in 2003 in the strategy document. We showed that we could produce, meet the in-state production goals that were identified in the Governor's Executive Order.

And what we also showed is that we could partially meet the greenhouse gas targets with existing programs. And what would be needed is a comprehensive program that fostered a greater introduction of alternative fuels in California in order to assure that we could meet the longer term greenhouse gas targets.

We also talked about a program, a comprehensive funding program, a long-term comprehensive funding program to accomplish the introduction of alternative fuels.

We also showed that over the long-term, between now and 2050, that rather sizeable private investment would be needed in order to make this transition from a petroleum-based economy.

And lastly, the goals that we established in the 1007 Plan, as asked for in the statute, was that we showed we could meet 9 percent of our transportation needs with alternative fuels by 2012, 11 percent by 2017 and 26 percent of the fuels by 2022.

And just to put these numbers in context there's a little statistic that we have used from time to time in workshops. The 20 percent figure that I alluded to earlier, if we used 20 percent of the fuel demand in California, that would mean that we would have to add each and every day between now and 2020 approximately one million gallons of new alternative fuel supply in California. So it's a daunting number, it's a huge number. But I just want to make sure everybody has this context of what we, the

challenge that we face.

Once this document was adopted we immediately began work on the Alternative and Renewable Fuel and Vehicle Technology Program. And we used this document, the State Alternative Fuels Plan, as the basis for designing and implementing this new program that came about, was established as a result of AB 118 and then later modified or amended by AB 109.

Essentially as Commissioner Douglas referred to in her opening remarks, the purpose of the program is simple, which is to deploy innovative technologies that transform the transportation market in California to meet the state's very aggressive climate change policies.

The statute provides us up to about $120 million a year for the next seven-and-a-half years. This first year, fiscal year '08-09 which we are in the middle of right now, we have a current appropriation for 75 million.

The grant -- excuse me. The statute provides us a great deal of flexibility in how we, how we dispense this money and gives us a good deal of flexibility in the types of financial instruments and mechanisms we can employ.

And it tells us we can award these funds to a fairly broad, excuse me, a fairly broad suite of entities to develop and deploy alternative fuels.

I am not going to go down each one of these but the statute essentially says with the money that we are giving the Energy Commission you can fund just about any project that's related to alternative fuel development in California, from research to deployment and implementation.

Now interestingly enough the statute and the authors of the statute were wise enough to also include eligible projects such as workforce training, education, promotion and public outreach and the development of technology centers in California. These are very, very important.

Particularly we are placing a lot of emphasis on workforce training and economic development through this program. It's one thing to have a program in which you deploy fuels and vehicles in the market. But to sustain that market you are going to need a workforce that is trained to service, to service these new technologies and service these new vehicles.

The statute also tells us that in

implementing this program we need to develop an investment plan and the investment plan is to identify the priorities and opportunities that the Energy Commission will employ in implementing the program. In doing this we have developed our Draft Investment Plan, it is posted on our website. In fact we had most recently, we had a hearing -- excuse me, an Advisory Committee meeting last week in which we presented, staff presented its recent Investment Plan.

The focus of the plan is to make use of existing alternative and renewable fuels that we could put into the marketplace now to begin this transition as quickly as possible away from petroleum. To grab and accrue as much greenhouse gas reduction potential as possible and as early as possible. And to also then begin to create this impetus for the long-term transition to a more diverse market.

And what we developed in the Investment Plan is a goal-driven strategy in which we would achieve the AB 32 target, the 2020 target, as well as provide investments looking over the horizon to the 2050 target.

And we did this through a two-step

process. The first step is just basically to identify the relative contributions of a number of alternative and renewable fuel options, the relative contributions to reducing greenhouse gas emissions.

And we started with the 2050 Vision that was developed in the State Alternative Fuels Plan. And that vision was developed jointly with the Air Resources Board when we developed the plan to give policy makers a glimpse of how significantly the transportation market would have to change if we are truly indeed going to meet the Governor's 2050 targets. I'm sorry, Susan?

ADVISOR BROWN: Five more minutes.

MR. SMITH: Five more minutes, okay. We broke this or divided this plan up into several categories of fuels, super-ultra-low, ultra-low, low-carbon and vehicle efficiency.

We did this analysis both for light-duty vehicles as well as medium- and heavy-duty vehicles. And the analysis that we did took into account the most recent demand, fuel demand forecast, the effects of the Pavley regulations and the effects of the Low-Carbon Fuel Standard. We also built into the analysis assumptions for

reduced vehicle miles traveled leading up to 2050.

And I'm sorry the image isn't any bigger but this is essentially our scenario. It is one plausible scenario of obviously many different scenarios that could be constructed but this is the scenario we developed for our Investment Plan for the light-duty sector.

The other thing I want to point out here is the purple bar, which is the super-ultra-low-carbon penetration vehicles as being largely of hydrogen and electric drive vehicles. The next bar down is ultra-low-carbon-vehicles, which is fueled largely by biofuels. And I only want to point those two out given the subject of the workshop today.

Corresponding then we did a medium- and heavy-duty analysis to examine the types of vehicles that would be needed out through 2050 and the penetrations of different fuels and vehicles to achieve the greenhouse gas reduction totals.

I'll very quickly pass through this. It's a Gap Analysis we did to identify where our funding would be most effectively used. And we identified other non-greenhouse gas activities that we would need to fund as part of this

program, including workforce training, more work in identifying and understanding sustainability issues, standards and certifications for fuels and vehicles, public outreach and education, analytical support to the program, and importantly, funding that would provide incentives for manufacturing and production facilities in California for fuels as well as alternative fuel vehicles.

Given the very short period of time I have left I will not go through each and every one of these recommendations for each of the fuel categories. Suffice to say that there is a large reliance on alternative -- excuse me, on biofuels as we, as we march toward 2050. And that I think is the essence of what we want -- the question that at least I want to raise and the question that is my staff's mind as we develop this Investment Plan. Are we analytically over-relying on biofuels?

I want to raise the question just simply for purposes of discussion because we are, as you can see from these tables, we are looking at rather large contributions to the 2050 targets by biofuels. And so we want to be certain that we

have enough feedstocks that we can rely on to produce these fuels and meet the targets.

This is just a summary of the recommendations that we proposed in our Investment Plan.

And I will conclude with this one slide that basically points out the concern or the issue that we want to raise. At left the years are simply the 2012, 2017 and 2022 target dates that came out of the Alternative Fuels Plan. The 2020 and 2050 dates are the greenhouse gas target dates.

But we wanted to show here that the biomass needed in order to meet these transportation goals, and we are going to add to that the biomass that might be needed to meet electricity goals, you have a total, the fourth column over, the total biomass demand.

When you compare that with what we know is available today you can see that we really quickly, by 2022 we really start to bump up against what we believe is economically retrievable today. And certainly to achieve the 2050 goal we see that.

Now this is analytical. I guess the

question that we need to answer as part of this workshop and future workshops is how can we produce more feedstock and more biofuels in California. I'm hoping that's what we will learn more today. Thank you very much.

ADVISOR BROWN: Thank you Mike for that excellent presentation. One of my tasks today is to try to keep us on track and on schedule. I am going to hold to our 15 minute per speaker limit to the extent possible.

I also want to comment that the issue that Mike raised on limits on feedstock availability will be discussed in our next panel on feedstocks so hold your thinking on that.

Procedurally what we would like to do today is -- first of all we are going to allow the Commissioners to interrupt you speakers and ask questions at any time. But I am going to suggest that to keep this orderly and keep it moving that we hold questions from the audience until the conclusion of the panels. So I am going to allow time at the end of our five first speakers for questions, comments, from the audience.

Our next speaker is Bob Fletcher. And we are very happy to have Bob here today. And he

is going to speak to you about the Low-Carbon Fuel Standard.

MR. FLETCHER: Commissioner Boyd and Commissioner Douglas, thank you for the opportunity to present here, live and in person. It's a pleasure to be here and to talk about one of my favorite subjects at the moment, our Low-Carbon Fuel Standard. Let me get my time clock going here so I don't get yelled at by Susan.

I think many of you may have seen this slide already. It's basically the motivation for doing the Low-Carbon Fuel Standard and what we hope to achieve. I know because of the smallness here of the slides it's going to be a little difficult to see. I know I was having some trouble and I'm closer than the rest of you.

And our objective really was to create this durable framework for a near- and long-term transition to low-carbon fuels, which of course includes biofuels.

And to establish a stable investment environment. One of the things that we always hear is that there needs to be a motivation to do this. We are hoping to do that.

We expect to expand the alternative fuel

market by three to five times by 2020.

And really to encourage technology investment and to reward those transportation fuels that have a lower carbon footprint.

We also know that with the LCFS we will be promoting both alternative fuels and alternative, lower carbon vehicles to use those fuels.

The overall approach is to achieve a ten percent reduction in the carbon intensity of the fuel.

We do that by setting a declining carbon intensity standard separately for gasoline and diesel fuel.

We then compare the alternative fuels to either the gasoline or the diesel standard depending upon what fuel that they are replacing.

And the whole system is set up on a system of tracking credits and deficits of the transportation fuels.

The key, kind of one of the most complex parts of the regulations is that we are requiring a full lifecycle analysis including indirect effects, both land use and other effects. And of the -- You know, just kind of a general comment.

The rates that I have worked on over the years, this one is one of, clearly one of the most complicated regulations that I have been involved in. There's just lots of little Inside Baseball issues associated with the LCFS that makes it a real challenge.

These are the baselines that we are using for the standards. Setting the carbon intensity in 2020, you know, based on what we think gasoline is going to be like in 2020. Which we are currently thinking it should be about a ten percent ethanol fuel.

Diesel fuel then is 2010 and ULSD without biomass-based diesel because there really isn't any significant penetration that would affect the carbon intensity.

The next two slides basically just show the pathway for the standards for gasoline and gasoline substitutes. You can see in the early years -- This runs from 2010 to 2020. And you can see in the early years we have a fairly gently slope allowing for fuels to come in. And then we ramp that down in the back end of the, of the schedule in more or less of a linear fashion. I think by the time we are done futzing around with

this one it probably will be looking pretty linear from 2015 on down to 2020.

Credits can be generated in any year for fuels that are cleaner than the standard. And those credits right now would have a unlimited lifetime.

You can see the diesel looks remarkably similar to the gasoline standard.

We are providing flexible compliance options. You can produce fuels that meet the standard.

You can blend a mix of higher and lower carbon fuels that on average meet the standard.

You can use previously banked credits.

And then you can purchase credits from other fuel providers who have earned credits by exceeding the standards.

So there are a number of issues. Forefront to that is actually determining what the carbon intensity of the various fuel pathways are. And, you know, for example, I think we have something like ten different pathways for ethanol depending upon what the process is, what the co-products look like.

I am quite certain we will not have all

of the pathways figured out by the time the regulation goes to our board. And then there will be other fuels that will come into play at later dates and so we have set up mechanisms in the rule itself that allow for these alternatives to come in and play in the LCFS regulation.

The availability, cost and impacts of the low GHG fuels and vehicles using these fuels are certainly an issue that we are addressing.

There has been, as many of you know who have been paying even the remotest sense to the LCFS, the indirect land use is one of the more controversial aspects, and direct effects as well for other fuels. So that one we are breaking some ground on and trying to do a thorough technical analysis and I'll talk about that one in a minute a little bit more.

Simple things like defining the regulated parties you wouldn't think would be that complicated but it is. Things like electricity. Who actually generates the credits, you know. Is it the consumer who are the ones that are actually putting the fuel in the vehicles, is it the electricity provider? Who exactly is the electricity provider? So just sort of the

mechanics of that become very challenging. We have literally spent hundreds of hours just talking about how to do this. Again, it may be that we don't have that completely figured out in March either and we may need to be coming back at the end of the year.

And then as Commissioner Boyd mentioned, the objective is to really have sustainable fuel production so we are looking at that. We are looking at how you establish sustainable feedstocks, what sort of reporting that represents. The indirect land use is part of the sustainability provisions but it's only part of it. There are many more aspects associated with sustainability.

We do have contracts in place with the University of California at Davis and at Berkeley that have been looking at various ways to establish sustainability metrics. And my guess is this is going to be one that will be coming back in future years with more defined. Because this one goes well beyond the borders of California so this is really becoming a national and international issue.

The fuel pathway carbon intensities.

This kind of just lists the pathways that we posted.

We should be updating the corn ethanol, the gasoline and diesel, CNG, hydrogen, electricity. The soybean biodiesel and landfill gas pathways should be updated with comments that we have gotten hopefully soon. Very soon is Fletcher-speak for I'm not really sure when they are going to be posted but I think they are going to be posted within the next week or so.

The additional pathways are listed here again. I'll just list them because it's hard to, hard to read them. But Brazilian sugar cane, renewable diesel from soybeans, LNG. And there are a number of different pathways for LNG depending upon how many pathways you have. If you are looking at Pacific Rim natural gas and you are liquefying it, shipping it, bringing it in, re-gasifying it, shipping it up, then liquefying it and then, you know, either taking it off and filling the vehicle directly, there is a number of different energy processes involved in that.

Palm oil-based biodiesel. Cellulosic ethanol, a couple of different pathways. Renewable diesel from waste. GTLs. And I'm sure

there's other pathways that can play and will be ones that we will be continuing to work on.

Let's take a couple of minutes here on the land use change issue just to, to kind of ground ourselves. It is really the conversion of new or existing land brought on by an increased demand for a commodity.

And the example that we used is perhaps natural grasslands or forests converted to soybean farming due to an increased demand arising from soybean cultivation being replaced by corn cultivation. So it's this kind of trickle-down thing that happens and it is a, again, that's an international kind of a global issue that we are trying to bring some, some evaluation into.

We have done that using University of California at Berkeley and Purdue University running basically an economic model that's the Global Technology Analysis Project, GTAP, to estimate different types of land conversion in different parts of the world, depending upon this commodity change. So we use that, we figure out where the land is converted then we apply emission factors to that. And then that allows us to calculate a total GHG carbon intensity.

For purposes of the preliminary results that we released in October, we annualized those emissions over 30 years, although the time reporting and how we do that is still an issue that we are, we are looking closely at. There's a number of different ways to do that.

This just lists some of the parameters that become important in this analysis. The type and volumes of fuel, the land types, the co-products generated, yields, emissions factors, and then I mentioned the amortization time line.

We do have a number of ongoing work in this area. Just for perspective, the preliminary estimate, and again emphasis on preliminary we are still looking, was 35 grams for CO2 per megajoule. this is the metric we are using for the Low-Carbon Fuel Standard. That was for midwest corn ethanol. So that, if you think of the gasoline being at 95 you can see that this is a fairly substantial contribution.

We are also looking at land use change impacts for biodiesel, Brazilian sugar cane. We hope to have those in the next two or three weeks, preliminary estimates for those. And then we will be following that with cellulosic ethanol and

other pathways as we go forward.

A biofuel will likely have no land use change when it is not derived from crops, it is derived from cover crops or similar types, or is derived from crops grown on land that's not supporting other crop growth. So we are looking at sort of the full range of doing it.

We have run to date, and have posted in our October supporting documentation, seven different compliance scenarios, four for gasoline and three for diesel, that we looked at how we would achieve the standard. And this is a mix of different types of ethanol with different levels of carbon intensity. And we have run different estimates of fuel vehicles and advanced vehicles to show that.

And that information is posted on our website. We are running some additional scenarios as well. But it does show that there is a pathway, it is supported if you see the standards that we put in. It takes a little while for the second and third generation biofuels to come in, which is why we are weighting the pathways a little bit heavy towards, towards the tail end.

Paul is going to talk about this. This

is simply the biofuel volumes. You can see that the green bars on this is the cellulosic biofuels. And it is going to be really important for the federal program to succeed for the LCFS to succeed, because if they can meet the RFS it means that they have figured out, we have figured out the technology to do this and to get plants on the ground. And that's really a key to, to the LCFS successes as well.

These are the time lines as they stand today. We have another workshop on January 30 where we will release revised language, updated land use estimates, our draft economic and environmental analyses. We will follow that with our traditional rulemaking effort with publishing the staff report and then carrying through to March.

I have listed December 2009 on there. Not only because it is the date that we hope to have the -- well, we really need to have the OAL process completed, but I am sure that we will be coming back to the Board with additional amendments in areas that we have not completely worked out in the March time frame. And I will say that March time frame, you know, watch the

space. There is a slight chance that we will move that to April but we haven't completely pulled that trigger yet.

So that's really the summary. The only other comment I would make is that the success of the LCFS is really going to be if we make it beyond our borders. We were very pleased to see the Northeastern States reach essentially a letter of intent and a memorandum -- to develop a memorandum of understanding by the end of this year to develop a low-carbon fuel standard. President-elect Obama has stated, you might have seen in the Sacramento Bee a couple of months ago, a statement that he was supporting a low-carbon fuel standard.

The standard will be much more effective if it is done on a national level because it avoids all sorts of problems like shuffling of crude oils, shuffling of fuels into California simply to meet our standard, where we might not get those sorts of greenhouse gases that we would otherwise -- benefits that we would otherwise.

So that's where we, that's where we stand and I think I have a minute left. But I'll donate it. I'll donate it to Commissioner Boyd.

PRESIDING MEMBER BOYD: You see me poised over my microphone here. Bob, a question for you. Can you back up to your bar chart. That one. Is non-advanced biofuels code for corn-based ethanol?

MR. FLETCHER: Yes.

PRESIDING MEMBER BOYD: Other advanced-biofuels. Can you give me an idea what that little slice means.

MR. FLETCHER: I am going to defer that to Paul just because I suspect that he is going to talk a lot about that in his presentation since his is on the EISA.

PRESIDING MEMBER BOYD: Okay, that's fine.

MR. FLETCHER: I mean, I can, I can do it but he is going to go through in some detail I think.

PRESIDING MEMBER BOYD: All right, appreciate that. That's all I had.

ADVISOR BROWN: Thank you Bob for that very comprehensive and complete presentation. Again, keep your questions in mind because after the next three speakers we will have an opportunity for discussion and questions from the

audience.

Paul, are you with us now on WebEx and audio?

MR. ARGYROPOULOS: I certainly am, thank you, Susan.

ADVISOR BROWN: Excellent. Well Paul, I am just going to let you take it away. We are very pleased Paul could be here with us virtually from the US Environmental Protection Agency. He is going to put this discussion we just had on the Low-Carbon Fuel Standard in the context of the Renewable Fuel Standard at the federal level. So take it away, Paul.

MR. ARGYROPOULOS: Okay, thank you. I'm sorry I couldn't be there in person. Believe me, I'd rather be in Sacramento today than here in DC.

I guess I can advance this just with the normal function keys; is that correct?

MR. NGUYEN: Correct.

MR. ARGYROPOULOS: Okay. I don't know if there's a delay or.

MR. NGUYEN: Can you click on the slide, please.

MR. ARGYROPOULOS: Okay. And then just page down?

MR. NGUYEN: Right.

MR. ARGYROPOULOS: Okay, thank you.

Just a real quick overview. I am going to give a very quick overview of where we are with the Renewable Fuel Standard we are currently operating under which is set forth under EPAct.

I am going to get into an overview of the development process for the Renewable Fuels Standard, calling it the RFS 2 under EISA, working on some of the more specific, detailed highlights of that.

I'll talk a little bit about some of the other implications coming out of EISA with regard to biofuels. Kind of where we are, the status and next steps.

EPAct established the first national program, a lofty goal of 7.5 billion gallons by 2012. Starting in 2006 we basically implemented a default rule. Congress basically gave us about four months to put forth a proposal, a final and implementation regulations into effect in a four month period. So that didn't happen but we quickly worked through that in record time. We got a proposal out and ultimately implemented the final rules in the spring of 2007 and then the

final program in September of 2007.

Of course EISA shortly followed that. But what it required was that we apply a renewable fuel obligation based on the volumetric requirements that would impact. And then apply those, turn them into a percentage basis to obligated parties who would then be required to either blend or trade for in credits, renewable credits, for renewable products so they could meet their obligations.

A flexible program was designed that if you weren't, didn't have easy access or cost prohibited access to ethanol or other renewable products to meet your obligations you could also meet that in a number of other ways. And again, I won't get into that.

It was based on an energy value and we equated the credits based on corn ethanol. We looked at the energy values of other products such as biodiesel that has a higher energy density there and therefore you would establish those credits. So one unique aspect of that was that the Act specified that cellulosic biomass ethanol would get a two-and-a-half to one credit. Again, that was an incentive along with a very small,

volumetric that was set forth in the Act.

EISA was signed in December of 2007. We quickly began work on that. Ultimately it set forth a number of major modifications to the RFS 1 program so it began in 2009 and I'll talk about those in the next couple of slides.

But we planned on and did utilize the process that we utilized for developing the RFS 1, a solid foundation to work very quickly and engage often with as many stakeholders as possible to develop the program. So that at the end of the day when we went to proposal we were pretty much near final and did the final sweep in a very efficient and timely fashion. And then go towards implementation quickly as well.

We have had a little bit of stumbling blocks on those over the past couple of months. I'll get into that a little bit later on. But we obviously had to work very closely with our other federal partners.

Here are some of the significant changes. The first, it increased the volume beginning in 2008. RFS 1 was 5.4 billion gallons, it immediately moved to the 9 billion gallon number set forth by administrative action last

February. The volumes are escalating from 2008 to 2022 to a total of 36 billion gallons.

And there's four new categories actually. Before it was one category of renewable fuels and you had a value for the various renewable products. And I am going to get into the specifics of what these categories are. One of the keys here is that it included not only volumetric standards for the various categories but also requires that these new products meet minimum reductions of greenhouse gases of the products to replace.

I am not going to get into the waivers, it's a very complicated issue there. But needless to say, Congress did recognize there were some potential issues associated with quickly expanding renewable products, the various types of products and also the fact that some of these products such as cellulosic ethanol is really not commercially available right now. Particularly in the volumes that we are looking at to increase (inaudible). So there are some provisions in there to address this.

And there's also some other studies and reports. This is an energy program. It does have

the environmental element, the base for the greenhouse gas emission reduction requirements and there are other environmental issues associated with the report that need to be (inaudible).

Just really quickly, these are the categories here. These are actually the specific categories of the fuels, biomass-based diesel has its own carve-out. It actually is a volumetric requirement. Beginning this year it is moving to one billion gallons. Basically these are static. These are minimums, they are not active.

Non-cellulosic advanced fuel category. I'll get into what the greenhouse gas values are on the next slide or two. And then cellulosic biofuel. And of course renewable, renewable fuel as well.

The lighter, the column on the left immediately there, really what we consider that to be is corn ethanol. And I think, Jim, that gets back to your question to the ARB. Conventional biofuels, it doesn't have to be corn ethanol but it was a cap of 15 billion gallons of corn starch based ethanol that was included in this conventional perspective.

The other key changes here. One, RFS 1

really only applies to gasoline. RFS 2 under EISA moved from highway gasoline to both gasoline and diesel and both on- and non-road fuels.

It also allows, even though these aren't part of the obligated volume standards, jet fuel and heating oil which are blended with renewable fuel can also generate or use RINs for compliance purposes. So it is an additional outlet for renewable products to be able to penetrate (inaudible).

There are some significant definitional changes. One of them is, again, the life cycle defined and it also sets the threshold.

The other one is the grandfathering provision. Again, that is -- I am not going to get into the details of that but basically what it allows is for those facilities that were in operation or basically under construction for that volume of those products to be able to continue to be sold into the market in a compliance fashion without actually having to meet a minimum greenhouse gas reduction threshold.

New renewable biomass definitions. It basically says that the feedstock to produce the fuels in order for it to comply have to come from

land that was previously cultivated prior to enactment. And there are some other specific land restrictions in there as well as those used from biomass (inaudible).

I want people to also recognize the advances of this program. We really have all the way throughout the supply chain issues that we have to deal with, certifying feedstock and the lands that came from, all the way to the distribution system for producing those fuels, impacting the greenhouse gas emissions. Both from the direct and indirect land use issue, the conversion of that. Energy sources and impacting how the co-products (inaudible). Really looking at everything all the way to the end use and how it affects greenhouse gas emissions. So there are compliance requirements, regulatory requirements that have to be imposed in order to verify all of this.

And again, we are not living in the conventional world that we had in the past with crude oil from a refinery and you regulate the emissions of the vehicles. And then adopt the emission control devices and the fuel restrictions that are applied to help support these emission

standards.

We have multiple interests, various sectors, multiple parties in those sectors. And the interests vary even within the sectors and it's all across the board. So it's kind of a game-changing initiative that we have had to deal with here. A very comprehensive effort going on to develop this program.

The critical element, as most people have been aware of and are interested in is the lifecycle assessment. Again, other than the grandfathered fuels conventional fuel must meet a minimum 20 percent lifecycle greenhouse gas reduction threshold. These are all compared to an established 2005 petroleum baseline.

Advanced biofuels. And Jim, this also gets to your point. They need to be a minimum of 50 percent lifecycle greenhouse gas reduction. We are expecting that sugar-based ethanol from Brazil is one of those that might have an opportunity to play in the advanced category and there are specific advanced volumes that are there. But the standard is that it must meet a 50 percent lifecycle reduction.

And again the biomass-based diesel.

That has its own volumes carved out. It also must be a 50 percent reduction.

And then the cellulosic biofuel. The most aggressive reduction requirement.

We do have the authority, and this is one of the little nuances that was also set forth in EISA, to adjust the lifecycle thresholds by as much as ten percent. We don't have to go a full ten percent. But really what that means is you can move from 60 down to 50, 50 down to 40 and 20 down to 10. You don't have to go all the way. But if some of these fuels aren't meeting those categories there has to be some way for these obligated parties to comply. So an adjustment is ultimately allowed under the authority.

This is a quick pass-through slide. one of the biggest issues, again, is the definitional requirements that we have the duty to evaluate. Really where most of the emphasis and focus has been, from the comments that we have been receiving externally on the analysis that we are doing, the indirect emissions are significant impacts on our assessment. And therefore that's why I would say over the course of the last four or five months really when the general results

have been put forth people have had some eyebrow raising over this. That's one of the reasons why we struggled a little bit to get the rule out.

This is what we are covering. Again, the direct emissions. All the way from feedstock, planting the seeds to harvesting the feedstock. The energy used to harvest those, the energy used in distributing the feedstocks to the biorefineries or the production of the biofuel ultimately to the final point of distribution.

There's significant assessment going on. We have multiple models that are being used. Actually certain recognition of the various models. I'm not going to get into these but we have, I think from an international perspective, the most advanced. Obviously we are working very closely with California and the international group, including the European Commission, on this framework. And also the information that is going into a significant amount of models that are necessary. There is no one, one model tool.

This next slide here is kind of a schematic of how all of these things fit together. The various models and the various parts of the supply chain from the biomass production all the

way to the fuel use. And then the types of models are there on the side that I won't go into.

But again, we have an incredible effort going on here. And there's one thing I do want to make mention of. We didn't just start this (inaudible). We actually did work under RFS 1. We were doing a lot of work for the refinement under the initiative, the Executive Order the President put forth in 2007, which was (inaudible). So it's not new to us.

The rulemaking as a whole. As I mentioned earlier there's a lot of different things that need to be analyzed under our regulatory impact analysis and framework for developing regulations. We really have to do an analytical approach to assessment for our rulemaking. These are many of the areas that we are covering in the impact analysis. Of course the agricultural section impacts analysis is critical along with the water and soil impacts and (inaudible).

Where we are right now. The package has been in inter-agency review for a while. Basically we sent to the Office of Management and Budget back in late October or early November.

What is required in the inter-agency process. We distribute that to the other agencies. They review it, they provide comments back through OMB to us and then we go into the process of making any necessary changes. They have a 90 day period to do that. We are nearing the end of that 90 day period right now.

We basically believe that we have received al comments other than comments actually from the Office of Management and Budget. Obviously we are not going to get this done before the administration changes but one of our priorities (inaudible). Therefore I have no idea when the proposal is actually going to come up but we hope it will be in the near future. How that matches up with what California is doing yet remains to be seen.

But we will need to ultimately issue a final and provide some level of lead time for the industry to be able to prepare for implementation. And again, our intention is to implement the program in 2010.

You had asked a number of questions. I think there's a number of things that are going on. Really what things are happening out there

both at the federal and state regulatory programs or policies that are forcing certain issues.

One of those is the Blend Wall, where we have restrictions about the percentage of ethanol that can be used in gasoline in volume percent. And at some point with these volumes, increased volumes, every gallon of gasoline in the country will need to have ten percent ethanol and then we will be beyond the ability to absorb in the additional gasoline pool the additional volumes required. So they need to go somewhere else or there needs to be some other type of biofuel such as biodiesel or biobutanol. Or actually penetration, higher penetration levels.

So that's one of the type of issues that out here. There's a host of them. There's a lot of federal work going on. Sustainability. Food versus fuel issues. Obviously the lifecycle modeling framework is a critical issue on the international front as well. Many, many activities, many, many issues, which I know you guys in California are confronted with.

And then the last couple of slides here. There are two other things. One is Section 204 of EISA. Again recognizing this is energy policy

even though there is a greenhouse gas component to it. There's a lot of environmental issues, air quality, water quality, biodiverse ecosystem issues associated with expanding the production of these biofuels all the way from feedstocks to the end use. So we are required under 204 to develop and to report every three years about the impacts or the potential impacts of the renewable fuels. We are working on developing that internally here at EPA and (inaudible).

One other interesting is Section 209 which basically says, okay, we're telling you that you need to implement this new Renewable Fuels Standard. But if there are adverse impacts in air quality as a result of these changes you need to look at what those are. And then ultimately we have been given, through authority, to require additional fuel regulations to mitigate to the greatest extent possible these impacts.

So that fuel program and our energy policy, they are giving us authority based on potential air quality issues, to look at and potentially develop another fuel regulation to mitigate that.

And that is a very quick, hopefully not

too quick overview from my end. Thank you for your time. I'm sorry I'm not there.

PRESIDING MEMBER BOYD: Thank you, Paul.

ADVISOR BROWN: Are there questions from the Commissioners?

Paul, thank you so much for that comprehensive presentation. I hope you can stay with us through the end of this panel because I believe there will be some comments and questions from the floor.

MR. ARGYROPOULOS: Certainly.

ADVISOR BROWN: Can you?

MR. ARGYROPOULOS: Yes, I will stay for the panel, thank you.

ADVISOR BROWN: Excellent, thank you.

With that I am going to introduce Fernando Bert$n from the Integrated Waste Management Board.

MR. BERT N: I'm delighted to be here. I'm glad it is much bigger on the screen because I was noticing that I was having trouble seeing the slides, even with glasses. Which means I need to make an appointment with the eye doctor.

A catchy little title, Harvesting the Seeds of Change -- Harvesting Emerging

Technologies. There seems to be an aversion to change in many ways but one of the things that I am going to be talking about are some of the policy drivers at the Waste Board. And a lot of it is related to the feedstock that I think can be provided for biofuel production.

So what I am going to be talking about specifically are the Integrated Waste Management Act then a series of strategic directives that the Board adopted back in February of 2007.

But before I do that I do want to set a little bit of context. And that is, you know, when the law, the Integrated Waste Management Act was passed in 1989 we were looking at a landfill crisis so the law required a 50 percent diversion by the year 2000. And while this slide shows data for 2004 we obviously need to be updated. We have actually achieved a 58 percent diversion rate for this year.

Unfortunately we have also increased our disposal. And we are still actually disposing of about anywhere between 40 and 43 million tons annually. So all we really have been able to do is divert our population growth. We haven't really seen any disposal reduction.

You will probably see this slide a few times today. This is basically the biomass resources in California. About 80 million bone dry annually from three main sectors, agriculture, forestry and waste. And obviously I'll be focusing on the waste part. A lot of that is in the LA Basin and the San Francisco Bay Area.

If you look a little more closely at the waste characterization in California, about 42 million tons is disposed of in 2005. Of that 42 million, 23 million tons is biological in origin. Plus we have about 5.7 tons of plastics and textile. So about half the energy value, 56 percent, being biomass materials. So we are burying a lot of BTUs and a lot of energy potential.

One of the things that we did was we undertook a study to look at the residuals coming out a materials recovery facility. And overall there's about 7.4 million tons of what we call post-MRF residuals. This is material that all the recycleables to the extent possible have been pulled out. And even with that we have 7.4 million tons.

And what is interesting, of that amount

26.1 percent are organic in nature. You've got 32, almost 33 percent that's paper, more than likely contaminated paper. What you have seen is a lot of jurisdictions go to single stream recycling. And while it may have a larger volume of recycleables being collected, with that single stream there has been some increase in contamination of some of the paper too. So the commodity brokers have rejected some of those loads. So the paper which, you know, has the cellulose in it, ends up being landfilled.

Also with plastic, just over 17 percent. Plastic has a lot of BTU value to it.

The other issue that, you know, we are dealing with is population growth. As this slide and the next slide show, our population growth will certainly increase our urban footprint. That means more garbage, more people, more cars, more need for gasoline or other fuels.

And as the next slide shows, a lot of that growth will occur actually in the Central Valley and in the Inland Empire. So we have to look forward and set the stages so that we can deal with the population growth.

It is increasingly difficult to site new

landfills. It is increasingly difficult to expand existing landfills. It is tough to even site a mini mart, forget about a compost facility or a conversion facility. So there's a lot of NIMBYism. Everybody wants their garbage picked up but nobody wants to put it down.

While this slide is very busy the main point of this slide is that of the biomass components of municipal solid waste there's about a 43.6 million ton barrel of chemical energy equivalent that's being buried. If you factor in plastics that's 23.4 million barrels of oil. All total, 67 million barrels of oil, of energy, chemical energy equivalent that's being buried in our landfills. So there's a lot of feedstock.

And one thing I failed to mention when I showed the slide about the post-MRF residuals, the Board has been very consistent, the Waste Board that is, has been very consistent in its message that the target material for these kinds of processes, whether it is for electricity or biofuel production, are post-MRF residuals. Those materials that are destined for landfills after all recyclables have been pulled out. So, you know, you have this debate of what's a higher and

better use, which I will discuss in a little bit.

From just another perspective. The energy from solid waste that is currently being produced, and primarily this is all electricity, we have got 30 solid fuel combustion facilities with a gross capacity of 640 megawatts.

About 60 landfill gas-to-energy facilities. And, you know, it's difficult to increase the landfill gas-to-energy production because of some of the very stringent NOx rules too. So we do have a project that is looking at converting landfill gas to CNG or LNG that we funded along, I believe along with the Energy Commission.

Now this is the issue of the higher and better use debate. Some of the technologies that are used to produce the biofuels, that can be used to produce the biofuels are high temperature technologies. So there is a perception of these technologies that they are incinerators in disguise and there is a real aversion to incineration.

Well from my perspective incineration is just volume reduction without harnessing the energy value or the chemical value. With

processes that can be used to convert the material that is destined for a landfill anyway into a biofuel, to me is not an incinerator.

There is also the perception that these technologies would harm the existing recycling infrastructure. Well a lot of these technologies don't want your typical recyclables. They don't want your metals, they don't want your glass. They could do without the One and Two plastic because they know that those have a higher recycling value. The film plastic, which really doesn't have much of a recycling market, are good targets for these kinds of processes.

So in many respects these kinds of technologies could enhance a recycling program. We did a lifecycle analysis back in 2003, 2004 where the analysis showed that a jurisdiction could increase their recycling by around 12 percent. Because what we would require from a permit is some sort of up-front recycling prior to conversion.

So you would essentially have three degrees of separation. The first degree being at the curb, at the home, the second degree being at the MRF, the third degree being prior to

conversion. So I can't make a Kevin Bacon game out of it, which is seven degrees of separation, but at least this is three degrees of separation. So, you know, everybody likes the product of biofuels but nobody likes the process. Well you can't have one without the other.

Regardless of that, the Board has adopted some policies to move forward. Strategic Directive 6.1 targets the organic, the biomass fraction of the organics being landfilled. And these directives were adopted by the Board in February of 2007 to sort of better, you know, set us down the path of achieving multiple goals for multiple policies, both in terms of the Integrated Waste Management Act, the Governor's Executive Order on renewable fuels and the RPS as well. So these kinds of processes using this kind of feedstock could achieve a number of, a number of goals.

This particular sub-directive, again, is targeted toward the largest fraction being landfilled and that's the compostable fraction. So we have these aggressive, this aggressive goal of 50 percent by 2020. What that really means is we would need 50 to 100 new facilities of any

sort, whether it's compost or conversion or something. So that's a daunting task.

And part of that task, if we are to achieve it, deals with Strategic Directive 8.4 in terms of enforcement and permitting. What this strategic directive does is have -- you know, we are to look at our regulations and make sure that the regulations are grounded in the best available science, address the existing and changing market conditions, and also to take advantage of developing technologies.

We look at our, we look at our existing regulations and a lot of these new technologies, there is no way to classify them because, you know, when these regulations were developed these kinds of biofuels technologies were just barely a glimmer in someone's eye. So the regulations aren't flexible enough to accommodate these new technologies. There is no box to check that says, other.

So we have to look at the existing statutes as well. Which is a whole other story. I can go off on that for a long time, which I won't because I don't want Susan's wrath. It's a nice wrath though. At any rate, so the bottom

line is we are looking at the regulations to make sure they are updated and take advantage of, and make it flexible enough to accommodate changing technologies.

Then the other important strategic directive is Strategic Directive 9.0 dealing with research and development of technology. You know, this sub-directive sets the foundation for coordinating our research activities to encourage the necessary innovations and technologies that are key to increased diversion and intelligent resource management. As well as, as well as accomplishing multiple policy goals, like the Governor's Executive Orders and RPS.

So SD 9.1 is to develop a focused process to coordinate those activities, 9.2 is to encourage the development of alternative energy and biofuels. It's pretty straightforward right there, you know. It's a major policy. So we're trying to, you know, see what we can do. Items 3 and 4 are pretty, pretty self-explanatory. Play an active role in the bioenergy interagency working group, which we are an active member, as well as the Climate Action Team.

A couple of things that I do want to

highlight as far as Strategic directive 9.2 on the alternative, as far as biofuels. We do have, we have sponsored a number of things. We did have a board-sponsored workshop back in March of 2007. We did this in coordination with the California Biomass Collaborative's annual forum.

In May of 2007 the Board awarded a grant to the Gas Technology Institute for a liquified natural gas system and a demonstration project at the Altamont landfill, which might be discussed a little bit further in Val's talk.

We also held a workshop in July of 2007 on bioenergy and biofuels-related activities that included a presentation by UC Davis on the feasibility of producing hydrogen from landfill gas and using hydrogen in landfill gas purification processes. That study, that report is available on-line. If anybody would like a copy just let me know and I can shoot you the link to it.

(Whereupon, Commissioner Douglas exited the meeting room.)

MR. BERT N: In addition the Board approved a contract with among others UC Davis and UC San Diego for a gasification project to look

at, to gasify among other things post-MRF residuals to mixed alcohols. And that project is taking place in Yolo County.

A couple of other things. There's the BlueFire Ethanol project in the Lancaster landfill that is moving forward. And we have also -- are undertaking, trying to develop a lifecycle tool that would look specifically at organic materials, the biodegradable, organic materials.

So we have -- The company that did the lifecycle analysis for us a few years ago is developing a model that would look specifically at organics that would be available to local jurisdictions or anybody where they can, they can tinker with it. It would be very user-friendly and much more compatible to their local situation. So they can, they can look at what the lifecycle implications of a certain amount, a certain type of feedstock using a certain kind of process would have.

So we are a little bit delayed on that project because with the Governor and the delay of the contracts back in late summer we got a little bit behind. But we do anticipate having that come to completion probably mid-summer.

And lastly, there is a proposal in Riverside County. It would be an anaerobic digestion project that would be co-located at a materials recovery facility. And the methane gas would actually be converted to compressed natural gas. That material, that CNG would be used to run the fleet of vehicles that the waste management company operates.

And that's about it. So if you have any questions I'd be happy to answer them afterwards. There's my contact information. If you want copies of the hydrogen report there is my e-mail. Thank you very much.

PRESIDING MEMBER BOYD: Fernando, could I ask you a question before you get away?

MR. BERT N: Sure.

PRESIDING MEMBER BOYD: Since Susan gave me permission to ask questions.

(Laughter)

PRESIDING MEMBER BOYD: You're getting quite a reputation today, Susan.

ADVISOR BROWN: I know, I'm getting embarrassed.

PRESIDING MEMBER BOYD: Fernando, before you got to your slide on perception of

technologies but after you had started I was suddenly reminded of the long years you and I have worked this topic together, biomass in general and all the -- And I wrote some notes to ask you a question which was about barriers to getting to or getting at landfill resources.

And my note said, recycling fears stifling the landfill, business fears, compost interference fears, fear of mass burning for electricity or energy are just plain incineration. Then you got to your slide on perception of technologies, which is a much more diplomatic and polite way of addressing problems.

But I won't protract this too long today. I have been at this for over ten years really directly and indirectly for lots of years before that. And these fears or these concerns or these barriers have been there the entire time. It is taking, in my opinion, us just way too long to knock down these barriers and to address these fears, thus we have not made the progress, in my opinion, that could have been made in this arena.

And we are really desperate now to knock down these barriers, solve some of these problems. Some of them actually involve legislation that

needs to be modified. But the only way we can do that is address these perceptions and knock down these fears. But I think that is going to have to become a very major component of our ongoing program in this year 2009 when we still just have terrible times getting at this resource material because of these perceptions or fears.

I don't know if you want to elaborate any more on the barriers in this public setting or whether we just keep at it. But I think it needs to be made a little more public because within the bioenergy working group, you know, we have been incredibly frustrated by running into these barriers constantly and not being able to successfully knock them down. So I see this as a very major effort we need to undertake in this year if we are going to finally get at this resource.

And in this world of the desperate needs of all forms of energy, of diversifying our energy base. And this moment I am not limiting it to biofuels but this is certainly a big one, we have got to get at this material and convince all these people that, as you did in your description of the slide, that there's room for everybody and it is

not going to eliminate anything, so on and so forth.

I don't know if that's a question or it's turned into more of a statement since you addressed the question. I don't know if you want to say anything more on the subject or whether you now become the key diplomatic leader of the effort and I stand in the, in the wings with my frustration and anger boiling up a little bit.

MR. BERT N: I'm not sure what else to say other than I agree with everything you say. It has been frustrating and it's frustrating for local governments too. So, You know, what some of the governments are doing, they're moving forward. Irrespective of any state policy they are moving forward. So that may be the policies will be pushed from the bottom up rather than the top down. Because they have a need to get stuff done and, you know, they can't be waiting for us. They have got waste management issues to deal with.

As an example, the Puente Hills landfill is going to be closing in 2013. That's 13,000 tons a day that has to find a home. And, you know, trying to parse that 13,000 tons a day in the LA Basin is going to be very difficult. So

we're looking at a $500 million rail haul system. And that's just to build a spur and the material recovery facility. That doesn't include, you know, some of the hauling costs.

You know, the other thing is that these technologies, it is not a panacea. These technologies are not a panacea. It's one in a menu of many, many options. I don't think these technologies will be built unfettered without, without environmental controls. There's a lot of feedstock to go around for everybody. You're not going to see 30 of these kinds of technologies built within the next ten years that will really pull the market away from this, that or the other.

As far as definitions are concerned, you know. Yeah, the definitions need to be based on science. Real science, not political science. And a lot of times you get addition by subtraction. That is, just delete the definitions in statute and let them be handled by regulation or by guidance. That's all I have to say.

PRESIDING MEMBER BOYD: Thanks. Thanks, Fernando.

ADVISOR BROWN: Thank you. We have one last speaker before our panel concludes and we are

hoping to take a break around 11 o'clock. And we will provide an opportunity again for folks to ask questions or raise issues with the panel members.

At this time I am pleased to introduce Valentino Tiangco. Dr. Tiangco is the lead for our advanced generation program in our Public Interest Energy Research group. So Val.

DR. TIANGCO: Thank you, Susan. I like this subject area a lot. For some of you who are involved in biofuels production since 1990, our motto for this subject area is Drink the Best and Burn the Rest.

(Laughter)

DR. TIANGCO: I make my own biofuel so I can say that. This is a short and abbreviated summary of what we have heard today. The initiatives affecting biofuel production in the state. Without spending much on this I have two slides, and have to add the AB 118 in these slides as one of the policy initiatives.

How much biomass resources do we have in the state? We have over 80 million bone dry tons of biomass fuels coming from agriculture, forestry and urban wood waste from municipal solid wastes.

Out of this 80-plus million bone dry

tons of biomass resources we have about 30-plus or 32 million bone dry tons technically available. Which is equivalent to about 507 trillion BTUs per year. These fuels are distributed throughout the state. And I will not dwell so much on this because Steve Kaffka will share more of the information on the amount of biomass feedstock in the state.

In terms of energy conversion pathways we have basically two conversion pathways. One is the thermochemical energy conversion pathway, second is the biochemical energy conversion pathway. To convert biomass to biofuels using all these biomass feedstocks that I have mentioned, agriculture, residue, forest residue and municipal solid waste.

In terms of using them for biofuel production, of course you need to process and handle properly these fuels. You need to have the proper equipment to separate the process to handle and also use them adequately for this conversion process. You can produce ethanol, biodiesel, methanol and other biofuels. And also you can produce power and other value added products.

In terms of the current consumption in

the state. We are consuming over 900-plus million gallons of ethanol in the state and also we are consuming over 43 million gallons of biodiesel per year in the state. In terms of diesel we are consuming about three billion gallons of diesel a year.

Executive Order S-06-06 set forth the target goals for biofuel production in the state. For 2010 there is a target goal to produce 20 percent in-state production of biofuel. The demand for 2010 is approximately 1.4 billion gallons per year so 20 percent of that demand is about .3 billion gallons per year, gasoline gallons equivalent.

And for 2020 we need to produce in-state 40 percent of the biofuel production. And the demand by that time is approximately 2.1 billion gallons per year so we need to produce in-state .8 billion gallons per year gasoline gallons equivalent.

And by 2050 the demand is about 3.9, we need to produce 75 percent in-state. And then the production in-state should be equivalent to 2.9 billion gallons per year gasoline gallons equivalent.

This chart shows also if we use E20, E10, E5.7 and also the diesel if you use B10, B5 or B20. And you can see the trajectories of how much we need to produce using those fuel blends.

We have in terms of ethanol production, there are as of yesterday 175 ethanol plants being built and producing about -- the capacity is over 10,000 million gallons per year capacity. This is information that has been produced by the Ethanol Producer Magazine yesterday.

And in the state we are producing -- I'll tell you. We are producing about 190 million gallons per year currently from the seven ethanol power plants using corn, cheese whey and beverage waste. At the moment one of the Pacific Ethanol plants is in idle mode. It was producing 40 million gallons per year.

Last year, early last year or late 2007 I reported over 80 million gallons per year. So this is progress, you are producing 191. But if you include the idle that's over 200-plus million gallons per year.

In terms of cellulosic biomass to ethanol. This graph shows some of the cellulosic biomass to ethanol projects in the entire nation.

We have three projects currently going on, one in Lancaster, one in Corona. They are both BlueFire ethanol projects funded by the US Department of Energy. And then the one in Brawley is the sugar cane, potential sugar cane to ethanol plant.

This chart shows all the DOE biofuel projects funded by the US DOE including the nine, small-scale biorefinery projects that got funded last year. The four commercial scale biorefinery projects, the four improved enzyme projects, the five projects for fermentation organisms, the five thermochemical syngas projects, the three Office of Science Bioenergy Centers, one located in -- You will hear a speaker on this one, on the Joint Bioenergy Institute, one I believe in Des Moines, Illinois (sic) and in Oak Ridge, Tennessee. And also this chart shows the five thermochemical bio-oil projects that got funded last year and also the six university projects that got funded late last year.

In terms of biodiesel. The entire nation is producing over 2,000, about 2,500 million gallons per year of biodiesel from 142 plants.

For the state we have at the moment nine

active biodiesel plants producing 63 million gallons per year. Last year I reported they were producing 46 million gallons per year so some plants added. And there are four idle plants.

And these plants are, shown in detail here, using virgin oils, yellow grease, multi-feedstock, waste grease, yellow grease, canola oil. There are nine active plants, I said, producing 63 million gallons per year of biodiesel in total. There is one plant under construction using yellow grease. Supposedly they will produce two million gallons per year of biodiesel. And there are four idle plants totalling 11 million gallons per year. Hopefully they will resolve the problem there so they can add more biodiesel production, biodiesel production.

That's all that I have in terms of the current biofuel production.

ADVISOR BROWN: Okay, are there questions from the Commissioners?

At this time I am going to allow the audience to ask questions of the five panel members, including Paul from the US EPA who is still with us on the phone. So if you have a question please come to a microphone and identify

yourself for the record, your name and affiliation. Chuck.

MR. WHITE: Chuck White with Waste Management. Listening with great interest to these regulatory hurdles or opportunities that are in front of us.

I did speak last week at the AB 118 and indicated that Waste Management is putting together a landfill gas-to-LNG plant. We hope to have it up and running at the end of this year. I've got some fact sheets here if anybody is interested. I did hand them out last week. About 13,000 gallons of LNG today.

And we are really looking forward to expanding the generation of fuels and energy from wastestream. Landfill gas the most immediate because about one-half to two-thirds of landfill gas is just simply being flared and not being used beneficially. And to capture this landfill gas and convert it into energy or fuels is really a high priority for us.

But the plant that would be required to do this, we are installing at Altamont, is a very expensive facility and it is necessary to get some help in funding to get these projects going and

off the ground. And in fact this project wouldn't be going forward if not for the funding support from the Waste Board, the Air Resources Board and South Coast Air District and others. So it's really important from the standpoint of the 118 program to really be able to provide some additional support to get these expensive projects off the ground and running.

In terms of -- So funding is a key point. Regulatory certainty is a key point. And one issue is this whole carbon intensity of fuels. And we are really -- Bob and his group are doing a great job with the Low-Carbon Fuel Standard, although the Air Resources Board seems to be having a difficult time getting its arm around biogenic versus anthropogenic emissions. And the recent Scoping Plan was kind of silent on how our greenhouse gas emissions counted from biofuels and biosources.

We have been asking for a long time for some clarity on this to make sure it is clear that a biogenic source of emissions is, the carbon intensity of that can be determined. There was an Errata sheet that came out from as part of the Scoping Plan that addressed this issue then it was

withdrawn. And we just hope in terms of regulatory certainty that the carbon intensity of biofuels will be clearly understood how we can calculate that and how it is going to be determined.

The other issue that both Commissioner Boyd and Fernando talked about is this whole diversion of waste from landfills. And it is certainly the need to be able to get diversion credit from diverting waste and converting it to energy or fuels. And there has been and continues to be obstacles. Every time we get into a discussion with an energy development partner to want to divert waste from a landfill and covert it to energy the first topic that comes up, well, is this going to continue to be viewed as disposal or will it continue, will it be viewed as diversion. And it's by no means a certainty.

One final question I do have though has to do with the funding. And the way AB 118 funding will help provide some funds for these kinds of biofuel development projects, which in turn may also generate Low-Carbon Fuel Standard credits that could be sold. And one of the questions we have, will the receipt of AB 118

funds to help put together one of these biorefineries make it impossible to sell credits from that program as part of the carbon intensity or AB 32 cap and trade system?

An example might be just hypothetically, if you were to generate potentially 100 credits from a biorefinery and 80 percent of the funding came from private capital and 20 percent of the funding came from 118, would we still be able to generate and sell 80 percent of those credits on the open market to help provide additional funding? Although it is speculative at this point in time because we don't know exactly how that market is going to play out.

But, you know, that would be able to provide further encouragement if we could also get some seed money through AB 118 and then also be able to sell some portion of the credits that would be generated under the Low-Carbon Fuel Standard or a cap and trade system. So we hope that there's some further clarity on the ability to generate credits from a project, even though it may be partially publicly funded. Thank you.

ADVISOR BROWN: Chuck, I heard about five or six questions.

MR. WHITE: Sorry about that.

ADVISOR BROWN: I think I got some of them. Did you want to pose a specific question to any one or more of the panelists?

MR. WHITE: Well the most important really is the 118 funding and will we be able to generate saleable credits from a project that is partially funded using public funds.

I got, through the AQIP program at the Air Resources Board the last time they seemed to be pretty negative on that concept. If any AQIP funding goes to support a project then you are never going to be able to generate any credits. The unfortunate point is that you are not really leveraging the maximum financial opportunity to encourage these projects to come forward.

AB 118 funding certainly can't pay for the whole thing, it can pay for a portion of it, seed money. But if we knew there was a certain portion we would be able to generate low-carbon intensity credits, that would be a further incentive to put more of these projects on-line faster.

PRESIDING MEMBER BOYD: Bob or Mike, do you want to each take a stab at this.

MR. SMITH: From the standpoint of the AB 118 program, the regulations, pardon me. The regulations, the proposed regulations that we submitted to the Office of Administrative Law a couple of weeks ago presently do not allow the use of credits if AB 118 dollars are used.

MR. WHITE: My own feeling is that's unfortunate. You are not taking full opportunity of the leverage that the funding could provide.

ADVISOR BROWN: Other comments or questions from the audience? We also have some folks on the WebEx so I think maybe I should go to those next.

ADVISOR SCHWYZER: Susan, I have a question for Paul if he is still on the line.

ADVISOR BROWN: Okay. I have a question from Diana Schwyzer, I have questions from others here in the room and there are also folks on the line. So Diana, I'll go to you first.

ADVISOR SCHWYZER: Okay, thanks. Paul, are you still there?

MR. ARGYROPOULOS: Yes I am.

ADVISOR SCHWYZER: This is Diana from the Energy Commission. I was wondering if you could give us a sense of how your modeling results

for the indirect land use change emissions of corn ethanol compared to the California Air Resources Board's preliminary estimate, which I think was 35 grams per megajoule that Bob Fletcher presented. And if you have a sense of how those results might impact the role of corn ethanol in the RFS, if at all.

MR. ARGYROPOULOS: Well I mean, ours is still in the pre-decisional process right now so I really can't speak very vocally about what the results are and how they may or may not be there. But from our perspective, from the program's perspective anyway, we are just looking at the overall emission reductions as compared to the 2005 baseline as to whether they comply or not.

So from a programmatic perspective, do you comply or don't you? And it is not necessarily, you know, how much better or how much worse you are than what the standard is set at.

With regard to the specifics of the actual emissions on that basis. I could put you in touch with our modeling people and maybe you could have an off-line conversation about that. I know that they are coordinating with people in CARB directly. I am not sure to the extent that

you guys at the Energy Commission are involved in all of these discussions but we have had some very detailed conversations on that. So whatever they have provided to CARB I expect we can provide to you.

ADVISOR SCHWYZER: Great, thanks.

ADVISOR BROWN: I am going to take one question from the floor next from Steve Shaffer and then I'll go to the WebEx question.

MR. SHAFFER: Steve Shaffer, now I guess a technical expert, formerly with the California Department of Food and Agriculture.

Paul, also a quick question for you under RFS 2. You alluded to land use restrictions to cultivated lands. Do you know how conservation reserve program lands are expected to be handled? Thank you.

MR. ARGYROPOULOS: My understanding is that whatever the restrictions are that were in the farm bill is what we will be applying in our assessments for the RFS 2 rulemaking.

ADVISOR BROWN: We have a question from Rain, a gentleman, I believe you were here last week at the Advisory Committee meeting, for Paul at EPA. Does EPA expect a delay in the

implementation of the biodiesel RFS in 2009?

MR. ARGYROPOULOS: We actually set forth the new standard for 2009 back in November. It was published in the Federal Register. And what we did was we provided the information which -- Number one, we set forth the volume requirement as was required in EISA for 2009, so 11.1 billion gallons. That includes the requirement for the biodiesel volume, biomass-based diesel volume.

In that we proposed a potential compliance strategy for the industry. And that was to basically say we are looking at, when we issue the regulations, to allow for the use of RINs that are generated this year in 2009 to be used one time only in 2010 for a combined 2009/ 2010 biodiesel standard.

So in other words, if you use them and you have RINs generated this year, even though there is not technically a biomass-based diesel standard because we don't have a regulation out for that, we are intending to, again this is pre-decisional, we are intending to apply a combined 2009, a 2009 to 2010 volumetric standard to each obligated party next year and to allow for the RINs generated this year to go towards meeting

that standard. If you don't we expect it would be difficult for obligated parties to actually comply with the combined standard. Is that clear? Does that answer your question?

ADVISOR BROWN: Correction here, that question came from Fred Wellons. And we are going to unmute the phone so if Mr. Wellons has a follow-up he can audible-wise ask it.

Apparently that addressed his question. Next Mr. Sparano has a question.

MR. SPARANO: Good morning, Commissioner Boyd.

PRESIDING MEMBER BOYD: Good morning.

MR. SPARANO: This is a little awkward. I have a few questions. But given the structure of the meeting I guess I need to ask them all now because all the panel members are here. The only person I don't have a question for is Fernando because the Drink the Best and Burn the Rest comment blew me away so much that my mind was shot for the rest of the presentation.

Being serious for the moment, I think the first thing to do is compliment the presenters, a lot of really good information there. For Mike Smith, a question on your fourth

slide, Mike. You showed goals to increase alternative fuels nine percent in 2012 and so on. Can you tell the group where CEC views how we stand right now at 1/1/09 versus meeting that goal. The first goal I guess would be the only one to address at this moment.

MR. SMITH: I don't have the numbers at my fingertips, Joe. I can provide them to you after this.

MR. SPARANO: Yeah, just looking for a perspective.

MR. SMITH: Sure.

MR. SPARANO: You know, we have certain goals and there's a lot of momentum and inertia heading toward those goals, not just in the group of folks who represent biofuel producers and the community of folks that are working hard at that but even with WSPA members who are investing in or are already invested in those areas. So I am just curious to get a sense of how that is going.

MR. SMITH: Right.

MR. SPARANO: And I would like to see that when you have a chance.

MR. SMITH: Sure. Well the first goal, if I recall correctly, we are well on our way to

the first goal, given the ethanol content of gasoline and the amount of biodiesel that is being used in California presently. So it's going to be the farther goals, the 2017 and 2022 goals that are going to be more problematic or more of a challenge to achieve.

MR. SPARANO: Okay. On the thirteenth slide, and I don't know any other way to do this other than to count the slides and ask the question. It showed light-duty greenhouse gas reductions. And I think you pointed out that a substantial segment of the emission reductions would come from hydrogen. I think the top --

MR. SMITH: That's correct.

MR. SPARANO: -- purple part of your chart. It was hard to see from the back, and even at my age, reading the small print. So 2016, 2018. How reasonable an expectation is that? I think that's where it starts. And right now we still, it appears there still are not viable hydrogen fuel vehicles out there. And certainly the infrastructure system at this point is almost non-existent; there are some but it's pretty small. So what are the pieces that get us from here to there?

MR. SMITH: Well the information that we have been receiving from the OEMs as well as the hydrogen and electric drive stakeholders is that there will be viable fuel cell vehicles to begin meeting and complying with the zero emission vehicle mandate from the Air Resources Board.

You are correct in pointing out that infrastructure will be, is absolutely essential to the success of that roll-out. And we are working very closely with stakeholders and with the Air Resources Board in identifying opportunities to invest in a hydrogen fueling infrastructure and the most cost-effective means of implementing a hydrogen infrastructure to begin to match the initial roll-out of these vehicles resulting from the ZEV mandate.

MR. SPARANO: And the third and final question for Mike. There appears to be, you showed on your last chart the potential biomass consumption. And it looks like in the years through 2022 there's a significantly greater amount of waste biomass available as compared to demand and then that switches out into the 2050 time frame. What is the --

I guess having biomass available is

clearly the first step and key to ensure that we use more and more biofuels from biomass. But the issue of the vehicles that will use the fuel and the infrastructure, again, just comes up in my mind as something that has to be a companion to having a viable and successful amount of material available. I guess that was more a statement than a question.

MR. SMITH: Well again you are correct, taking hydrogen, for example. Initially, in these initial years the hydrogen that will service the transportation fuels market is going to be largely produced from, reformed from natural gas. But as we move into the out years, to truly achieve the deeper GHG reductions that are part of our scenario and that I think that everybody is hoping for with hydrogen is going to require a substantial use of biomass feedstocks and renewable energy for that conversion process.

Electric drive in the out years. Also the electricity as the fuel will also need to be derived from, a sizable percentage from renewable fuels. There's also built into that scenario the demand for biofuel vehicles.

And so just about every fuel that is out

in the 2050 time frame, in order to be viable in the 2050 time frame, is going to have to have some sort of renewable component. So from that standpoint it was, in looking at the numbers, we only wanted to point out in this slide that, you know, we may have a challenge going into the out years if we are going to rely on biomass feedstocks and biofuels. And if we are going to pursue a policy in this state of relying on waste material as a feedstock largely and developing an in-state production facility for these fuels.

We may have some challenges facing us. Not that these numbers are cast in concrete. I think the challenge in front of us is how do we increase the amount of biomass feedstocks available to us to accommodate the growth and demand for these fuels.

MR. SPARANO: Thank you, Mike. I have a couple of questions for Bob Fletcher. I just wanted clarification. I think you -- And I couldn't tell because I didn't have a handout to read and I just couldn't see the slides as well as I would have liked. So if I am mis-informed, Bob, just cut me off. That's happened here before but not regularly.

(Laughter)

MR. SPARANO: I just wanted to make sure you were still with us, Commissioner.

PRESIDING MEMBER BOYD: Almost made it through the day.

MR. SPARANO: Bob, I think you talked about a phased approach. And if I read it and heard you right we were all looking at March as a date for adoption, or at least an adoption hearing for the LCFS. And I thought I heard you say given the tremendous amount of work still to be done on examining, doing the full life cycle analysis for a pretty broad suite of fuels and looking at the carbon intensity and verifying carbon intensity for each fuel, that you were looking at going ahead, you being CARB, and then in December or at year-end revisiting that. Did I hear that correctly?

MR. FLETCHER: Yes. I think there are some issues that are going to be really difficult to square away by March and probably are not critical to square away by March but need to be squared away, you know, fairly soon thereafter. And I think we took a few more months to do that. One of them may be things like the electricity

regulated party, for example. To make sure that we get that right. So there's, you know, probably a half a dozen issues like that that we would expect to come back for rulemaking in December.

MR. SPARANO: Do you expect that by March you will have the indirect land use components pinned down or is that something that would be done in the intervening period? Because I know that is something you have addressed a little later in the process than when you first started.

MR. FLETCHER: Well our expectation right now is to have an indirect land use for corn, for sugar cane ethanol and for soy biodiesel as a start.

MR. SPARANO: By March?

MR. FLETCHER: Yes, by March. And cellulosic if we can get it but I am not sure we are going to, we are going to have it by then.

MR. SPARANO: Okay. And speaking of the cellulosic. I guess I'm interested in, and maybe you could clarify the basis for concluding, again if I read the material right that I could see, that cellulosic ethanol will be available in commercial quantities by 2012. I think that was

the date at which it first showed up in the, in the LCFS.

MR. FLETCHER: I think you are not reading that right. What we have is a compliance path that comes down and, you know, there are -- If that's the graph if you are referring to.

MR. SPARANO: Yes.

MR. FLETCHER: That's the EISA. That's the federal act. That isn't our, you know, that isn't our estimate. That is the biofuel volumes that are required to be in place under the federal EISA. So my comment was it is going to be really important that the federal EISA is met to ensure that the LCFS is met. I mean, we believe cellulosic, particularly in the later years, maybe not so much in the early years, but in the early years are certainly going to play a role.

MR. SPARANO: Is it CARB's expectation that the federal EISA will result in enough cellulosic being available to meet the LCFS needs?

MR. FLETCHER: I think that what my point was, if there is that volume of cellulosic ethanol to meet the federal EISA then we figured out the technology of how to do it. And if that is the case then it's a question of economically

building plants and producing the fuel necessary.

If we just look at the federal EISA we think that that gets us about halfway to the LCFS on a quote, you know, sort of a fair-share perspective. Our objective is to not suck up all the clean, cellulosic ethanol in the country and bring it to California for various reasons. So it's a question of ensuring the technology is developed and is working.

MR. SPARANO: Okay, thank you, Bob.

Commissioner, I still have a number of questions and I feel like I'm monopolizing the mic. I don't know if you want to have me stand aside and someone else ask questions and come back later or what.

PRESIDING MEMBER BOYD: How many more questioners do we have, Susan?

ADVISOR BROWN: We have one on the phone and at least two in the room.

PRESIDING MEMBER BOYD: Joe, why don't you --

MR. SPARANO: I have three more questions.

PRESIDING MEMBER BOYD: Keep going, yes, keep going. Let me make one quick comment. We

had a meeting in this room Thursday of last week of the, as Mike Smith indicated, of the AB 118 Investment Plan Advisory Committee. I am not sure, I don't recall seeing any of your folks in the audience. There may have been members in the audience.

You might want to have folks look at the materials that were presented there, which I am sure are posted on our website. Honda had a very interesting presentation on their views of hydrogen and their program, which is admittedly extremely aggressive, including carbon footprint data from studies on hydrogen from either reformed natural gas.

And then you can always -- The Fuel Cell Partnership didn't make a presentation but they did give us extensive comments in writing, I believe Mike, which are probably also posted on the Energy Commission website for that, for the topic of the AB 118 Plan. It might be a little additionally informative.

And the other, the other comment on your question about where we stand on progress. Mike, probably sometime during the day you can take Val's data and the two of you can do a little bit

of, a little math and quickly come up with, well how close are we to meeting the current day or the almost present goals of biofuels in the California transportation fuel mix. Just for a one-pointer.

Anyway, go ahead with another question.

MR. SPARANO: The next two questions are for Paul. Are you still there?

MR. ARGYROPOULOS: I'm still here.

MR. SPARANO: Okay, thank you. Based on the information that you communicated I'm curious what the EPA's view is on how renewable fuels production is coming along, specifically with what I will call the next generation of biofuels. Starting I think this year and moving forward there is an increasing amount or there are increasing amounts of next generation biofuels, whether they are biodiesel or what I am concluding is mainly cellulosic ethanol, ethanol from cellulose. How does that look to EPA at this point in terms of meeting those goals, particularly in the near year?

MR. ARGYROPOULOS: Okay. Yes, there are some standards that are coming along. We have some that were advanced this year which would require technically that compliance provisions in

place (inaudible) production and then actually cellulosic beginning in 2010. So a much lower volumetric requirement. But they do escalate and ramp up fairly quickly.

We meet with a lot of technology providers, there's a lot of optimism out there. There's a number of different pathways which are, we believe can be commercially demonstrated. The reality is whether they are, whether the economics are there given current or future circumstances. I think those are things that we still have to, to kind of work through.

But what our requirement is is to -- we actually set the standard. Even though there are volumetric standards for cellulosic biofuels each year, we are required by the Act to use energy information, administration data, as well as we will be analyzing market data.

So going out to the market and looking at, is there concrete and steel being put in the ground? How far along are those? What are the volumes that those facilities are looking at producing over the course of the year? Are the feedstocks there? Do they have suppliers in line and so forth? Then to actually set the standard.

So let's say it's a billion gallon standard just for the purposes of speaking. And we do an evaluation and we believe that the commercial viability of the market in that forthcoming year is only 750 million gallons. Then we would set the standard at 750 million gallons.

But again, it's premature to say what it is or isn't at this point but we do continue to meet with those people. There's a lot of optimism. I know there's, I think there's one facility that is coming on-line or came on-line recently at 20 million gallons a year. So there are stories out there and we believe that those stories are actually becoming a reality. And over the course of this coming year we will need to actually make the assessment and set the first year's standards.

MR. SPARANO: Thank you. The other question I had was you mentioned facility grandfathering. My interest is, would that grandfathering apply say to corn-based ethanol facilities that are under construction but not completed?

MR. ARGYROPOULOS: Yes, there's two

levels of grandfathering provisions. The first one is if you were in production or began construction prior to enactment of December 19 of 2007. Then technically if you are a corn ethanol facility you are grandfathered, your volume is grandfathered. So whatever the production --

And again this is pre-decisional. There's a number of ways that we are looking at approaching this, whether it's actual historical volume that was produced or if it's actual production capacity. So, you know, whatever that ends up being and where we finalize it I don't know yet. But those are some of the, some of the ways we would be looking at it. You would then, your volume would be grandfathered in in meeting the compliance requirement.

The second aspect of that on grandfathering is after enactment. If you began construction after enactment, so between starting in 2008 and 2009, between that time and 2010. Then your facility would be deemed to be compliant if it is fired with natural gas, biomass or co-with natural gas and biomass. It is required to meet the 20 percent greenhouse gas threshold but it basically says that you will meet it if you are

using those two energy sources in production.

And again, how we will end up finalizing all the nuances of that remain to be seen. But those facilities generally speaking would be grandfathered. So if you -- Even if you hadn't completed construction, if you began construction prior to that and you completed it before the time period, then you are going to be grandfathered.

MR. SPARANO: Okay, thank you. And finally for Valentino. I thought I heard you or saw in the, in the materials that there was a component of E20 used in 2010. I'm not sure how that is accomplished given the current auto view on E10 and warranty -- E20 and warranties.

We are just moving by CARB in the direction to E10, Bob, correct me if I'm wrong, 1/1/10 for E10. So E20 seems a bit optimistic and I am just curious how that enters into the, into the formula here.

MR. FLETCHER: I am not sure in reference to Val's but, you know, we are moving --

MR. SPARANO: It was slide seven.

MR. FLETCHER: We are not requiring E-10, that is an option for meeting California's predictive model. And those volumes, that is not

an E20. What that is saying -- If that is the slide you are referring to.

MR. SPARANO: Yes it is.

MR. FLETCHER: What that means is of all of the fuel that's produced in California -- Of all of the biofuels that's used in California, 20 percent of it must be produced in California. Those are goals from the Executive Order S-06-06. So it is not an E20 requirement, it is just 20 percent of how much ever biofuels are used in California at that time should be produced in California.

MR. SPARANO: I thought there was E-20 in the parens there and maybe that's my confusion.

MR. FLETCHER: No, I don't think so.

DR. TIANGCO: It's 20 percent. Likewise in biodiesel, 20 percent biodiesel.

MR. SPARANO: Okay, those are all my questions and I thank you for giving me the time.

ADVISOR BROWN: I have one more question for Paul at US EPA.

MR. McKINNEY: Hi Paul. My name is Jim McKinney, I'm staff here with the Energy Commission. I had a quick question on the Renewable Fuel Standard and the definitions around

forest biomass.

And as you may be aware the Energy Commission decided not to use that definition in its implementing regulations for AB 118, which a particularly challenging issue for the agencies in California working on this. And can you talk a little bit about what the federal agencies are doing on defining sustainability standards for forest biomass.

MR. ARGYROPOULOS: Well, I am not going to be a very good one to respond to this when we have a couple of people that are knee-high, cornfield deep into a lot of these issues. The requirements that are set forth in EISA is what we are trying to apply on the biomass side. They are very complicated, we know what the intent is. But actually developing a program to enforce those provisions is very challenging given the availability of data.

The definition is fairly clear in the Act. However, how you go about assuring that the actual feedstocks from the various lands to the ultimate producer, renewable fuel producer, are indeed meeting all of the not only the renewable biomass definitions but the land use restrictions,

requirements, et cetera, is significantly challenging. To get into detail on that I think is probably -- It confuses the hell out of me.

(Laughter)

MR. ARGYROPOULOS: So I think it would be better that we had an off-line conversation on those specific issues. So we can let you know at least generally what we are doing and potentially what we plan on proposing. Because there will be a number of options. But it's something that we are actually still working through and have been working very intently. Not only with the feedstock producers but USDA and a host of others.

PRESIDING MEMBER BOYD: Paul, this is Jim Boyd. A quick comment. I want to thank Jim McKinney for raising the question because -- and for pointing out that we have got some differences of opinion on this subject. And I want to reference something that was said by Fernando when he talked about the Waste Board. And that's just this perception of technologies or perceptions of issues standing in the way of our ability to make progress.

And one of these long, long held perceptions that we have encountered, obviously

for a long, long time, has been that -- and it's a problem for us therefore with this federal definition and it's been a problem for us within California government. We have different points of view on this, quite frankly.

But the problem being there is a perception that if you let people -- I'm just going to say, us. If you let us in the forest to gather waste material the next step will be maybe addressing forest trimming and thinning for forest health issues. And there is a perception out there the next step would be logging all the old-growth forest down.

And we are having a terrible time convincing people that, you know, not everybody is evil. You know, those of us who would like to address getting that waste material and putting it to good use.

And those of us in a past life, as Deputy Secretary of Resources I was worried about forest health and a fairly strong-held belief that, you know, some thinning and trimming might not be a bad idea for forest health. And oh by the way, we are burning them all down anyway with all this mass material in the forest. We have got

to get in there and begin to address that problem and knock down this myth and this barrier.

And to have taken the easy way out -- sorry Bob Fletcher. To have taken the easy way out and accepted the idea that we will just embrace the federal definition, which has stopped us dead in our tracks again and caused no debate of this issue and preclude therefore maybe some progress on this issue. We are in a position where we just can't wait that much longer. One, we are burning the bloody forests down hand over fist now because of population densities getting close to all this waste material. Smokey the bear was wrong, et cetera, et cetera.

So I appreciate the dilemma you are going to have in discussing this at the federal level. And just recognize that we here in California have wrestled with it, have different points of view and probably have some things to contribute to the national debate on the subject. So thank you.

MR. ARGYROPOULOS: I appreciate those comments Jim and I hear you loud and clear. I know you probably know we are struggling with this on many fronts. Figuring out how to work through

this, be as flexible as possible and as logical as possible, given the definition that we have been handed in meeting the legal, the legal tasks that are before us. I won't say we'd welcome the debate because I think we have been having it, but we'd welcome the opportunity of a more productive outcome.

PRESIDING MEMBER BOYD: Thanks.

ADVISOR BROWN: Thank you. We have one last question on the WebEx. I'm sorry. Bob, did you want to make a comment?

MR. FLETCHER: Just two quick comments actually. One to Jim's comment. We have not yet made a decision on how to handle the renewable biomass. We are actually meeting with a number of the forestry folks. Last week, we are meeting again this week. We will be meeting with some of the environmental folks later in the week.

What we have in the LCFS right now is just simply we extracted the federal definition and put it in there and said, we're accepting comments. But I don't want that to be interpreted as that is our decision on what we are doing with this definition because, quite frankly, we haven't made a decision.

PRESIDING MEMBER BOYD: I appreciate hearing that and I withdraw my comment.

(Laughter)

MR. FLETCHER: The other, the other consideration is, is I think there is a common objective. At least my sense is there is a common objective. Is whatever is done to pull that biomass out is done in a sustainable way that has conditions associated with it.

And if that, if we can reach that sort of consensus then you have a situation where it really doesn't matter whether you define it as not letting you use federal land material unless you meet these requirements, or you can use this material but you have to meet these requirements.

It shouldn't make any difference which way you come at it if the objectives are clear and the definitions are clear. But I think there's some work. And you've hit it on the head in terms of there's a lot of trust issues out there with how you access this material.

The other quick comment I wanted to make was to Joe. We were looking at the slide and there is actually an E20 on there and that came out of the AB 1007 work. And I think what it was

was a surrogate for the total amount of ethanol in the fuel divided by the amount of fuel. And it wasn't intended to be an E20 fuel, it was the combination of E10 and E85 fuels I think. Is that clear?

ADVISOR BROWN: That's my recollection as well, Bob.

PRESIDING MEMBER BOYD: I think I an say from a policy perspective our two agencies are operating under the premise that E10 is the end of the line for the foreseeable future, if not permanently. And, you know, we are not engaging in much in the way of debates beyond E10 at the present time.

ADVISOR BROWN: Yes. I have one last question I am going to pose to the panel. And it may well be a question for the next panel, from Rain. Why are we still researching corn and other consumeables for biofuel when algae shows far greater productivity and promise? Anyone here want to address that or should I defer it to the next panel, which I believe is going to address the subject of algae as a feedstock?

MR. FLETCHER: I would defer it to the next panel. It is a fuel that can play in the

low-carbon market. It is a competitive fuel and, you know, a lot is going to depend on what the price of oil is.

ADVISOR BROWN: Thank you. I think we will do that then.

We would like to take a ten minute break unless there are other comments. I'm sorry, Mike.

MR. SMITH: Yes.

PRESIDING MEMBER BOYD: Make it closer to a five minute break.

ADVISOR BROWN: Okay.

MR. SMITH: Susan, I just want to clarify my response to Chuck White.

ADVISOR BROWN: Sure.

MR. SMITH: To his question regarding credits. In looking at our specific regulation language, the default in the language is for non-eligibility. However, there are some exceptions to that that you may want to take a close look at.

MR. WHITE: I'll come and talk to you during the break.

MR. SMITH: So there is a certain flexibility built into it, so I just wanted to clarify that.

PRESIDING MEMBER BOYD: I'm glad you

mentioned that Mike because I know internally we debated this ad nauseam. We are quite concerned about stifling and yet quite concerned about the other issues. There is an escape route with lots of checks and balances built in.

ADVISOR BROWN: Again my thanks to the panel. We are going to take a break until 25 until the hour and I am going to ask the next panel to convene. Thank you all.

MR. ARGYROPOULOS: Thank you. I am going to sign off, Susan.

ADVISOR BROWN: Thank you Paul for hanging in there with us.

MR. ARGYROPOULOS: Okay. Good luck with the rest of the day.

ADVISOR BROWN: All right, thanks.

Whereupon, the morning recess was taken.)

MR. McKINNEY: Hi, my name is Jim McKinney. I am staff with Mike Smith's team on the AB 118 program and I am going to be the moderator for the second panel, which is going to look at feedstock availability in California and the West from a number of perspectives.

We have had a bit of a program shuffle

so first is going to be Steve Shaffer talking about the potential for energy crops. Then we will have Steve Kaffka, professor at UC Davis, talking about in-state resource availability. And then we will have Alex Schroeder from the Western Governors' Association I think giving us kind of a Western Regional perspective on this.

Due to the length of the discussions with the last panel I am going to ask the speakers to kind of move as smartly through their presentations as possible. We don't want to cut out the meat but we are going to try to make up a little, a little bit of time here.

So with that I want to introduce Steve Shaffer. So for 34 years Steve worked with the California Department of Food and Agriculture and he started his work in the biofuel sector in 1981. He directed the office of agriculture and environmental stewardship from 2000 to 2008. And as he said with a big smile in his voice, he is now retired and gets to come back as a technical expert and really have the best of all worlds. So with that let's welcome Steve and I look forward to his presentation.

MR. SHAFFER: It is a pleasure to be

back in this room. I have been here many, many times. I expect I'll be in this room many more times. I don't know if I will move through my presentation smartly but at least quickly.

I feel my role today is sort of to tee up a number of issues and questions. Steve Kaffka will follow me with a lot more of the numbers and the hard data I think. But I think there are some tremendous opportunities for biomass to be a part of the energy solution moving forward in California.

You know, I am not sure if I coined the term Energyshed or not but I Googled it and I didn't really find much on it. But I want to put out this concept just -- and I'll talk about that just real quickly. Again, identify some of the issues. I want to give some key examples and then wrap it up.

So we are familiar with the terms watersheds, airsheds, foodsheds, et cetera. Why not energysheds? And really to address energy at the local level as Fernando had mentioned from more of a bottoms-up, grassroots perspective where collaboration is key. But in order to do that you need to build that human capacity, that human

infrastructure to do that.

I think the Energy Commission's RESCO program is a good move towards that. I have my own comments on that program in terms of it is still I think a bit cumbersome and bureaucratic, especially if you are working with local folks at local levels but it is definitely the right idea.

We heard a lot on the biomass resource potential. This is just, again, conceptually how much biomass there is globally, how much the world uses. This is food, fiber, energy. How much the US uses. So just again to conceptualize the potential.

Of course you are not going to utilize all the biomass or even a large fraction of it. But it is still, in my mind, an under-utilized resource. We heard alluded to the different feedstock assessments. I won't belabor that. And then what that means in terms of production of liquid fuels.

We all know, I think, that there is a diversity of fuels. I like to say we are moving towards a poly-fuel future and that just lists those.

(Whereupon, Commissioner Douglas

rejoined the panel.)

MR. SHAFFER: I put energy crops in quotations here because the agricultural residues I want to consider as an energy crop as well. They are part of the existing agriculture system. They are quote/unquote the low-hanging fruit. What is available currently irrespective of the development of dedicated energy crops.

Again the sort of systems analysis, lifecycle assessment, whatever you want to call it in terms of highest and best use of these materials. Whether it is better to put it back in the ground. Whether it is better to utilize it for other end use materials, construction, clothing, whatever. Or whether it is best to use it for energy. And that gets back to that energyshed concept where local collaboration and development of a strategy I think needs to take place.

We know the conventional crops. I list sugar cane in there because of course it's, there has been a lot of agronomic work done on sugar cane. Sugar cane ethanol, I want to be clear, is not being considered a conventional biofuel in those regulatory processes in the Low-Carbon Fuel

Standard and EISA and what have you. But it is a conventional crop in terms of its agronomic development globally and in the US and potentially even in California. Dedicated crops. And just conventional crops I did not list soybeans because soy isn't grown in California.

Dedicated energy crops. Sudan hay is more of a conventional one. That's why we have grown some of the elephant grasses, energy canes, energy grasses. Trees, eucalyptus, hybrid poplar, a number of others. MegaFlora is another one that has been getting some attention too and I'll talk about that in just a little bit.

And then other unconventional crops. And I include algae as an agricultural crop that has come into the fore.

The issues we heard, these have been alluded to in the previous panel as well. You can read through those very quickly. I want to just highlight multiple objectives management. Because again it gets back to the systems analysis.

And looking at another term of art perhaps is net environmental benefit. And so there are, for example, anti-backsliding provisions in some of the federal and state

regulations in term of criteria air pollutants, for example, or water quality.

But are there ways to incorporate all of that where you may have some transient de minimis effect on say water quality or air quality in getting some of these biofuels into production? But those eventually through additional technology improvements and what have you are eliminated in a reasonably short period of time.

Biotechnology. Genetically modified organisms. In plants, in microorganisms, what have you. What are the rules of the game? What's the regulatory process going to be? What's consumer acceptance going to be? So I see that as a big issue.

End use technology. A little bit of a discussion on, you know, there's E10, there's E85, there's not much in the middle. And how can that -- That to me is one of the barriers if you are just focusing on, on ethanol as a fuel. That needs to be addressed. Further technology development in terms of ethanol as a fuel cell feedstock would be another for example.

And then economics underlies all of it.

Just again, these are a couple of slides

from Michael Wong at Oak Ridge National Lab and also from Alex Ferrell at UC Berkeley. Different ways of looking at the benefits of biofuels as a petroleum replacement and its efficiency as a petroleum replacement. Also in the previous slide, its efficiency on an energy basis as well.

So very quickly to move through some examples. And the reason I do this is there are opportunities up and down the state of California but they are very site-specific. They are very regionally specific and therefore the work, again, needs to be supported from the grassroots up.

So in the northeast part of the state. The Klamath Basin used to be a large sugar beet growing area. The economics of sugar have precluded that. The industry basically doesn't exist anymore up there, does it, Steve? But it was thriving. It was in Solano County as well. Are there, are there through agronomic development of fodder beets, fuel beets, what have you, opportunities to bring some of that back?

Sweet sorghum I demonstrated in an Energy Commission program back in the late '80s and early '90s when we grew it up and down the state. And it grew well with lower inputs than

corn and on and on and on.

Again looking at the multiple objectives management approach. Looking at rice straw utilization, additional habitat corridors that can be managed both for wildlife habitat and biomass resource development.

Reinventing Delta agriculture. This is where algae production may come into play. You are looking at brackish water. You are looking at CO2 from power plants and oil refineries. You have a resource base there. Can the technology be developed to take advantage of that resource base and reinvent Delta agriculture into aquatic agriculture that is compatible with some of the objectives of the Delta Vision task force and all the issues having to do with the Delta and maintaining levees and moving water through the Delta, et cetera.

Rotational crops and high value systems. Some of the Salinas lettuce growers when they were faced with the high energy costs were looking at they may not be able to compete with East Coast lettuce production for their summer crop. They grow three crops a year, a spring, a summer and a fall crop of lettuce. If they can't compete with

it because of energy prices and the cost of getting the lettuce to the East Coast with East Coast production what is their next highest and best use for utilizing that ground?

And they came to me talking about canola or wild mustard as an oilseed crop where they can defer some of their diesel costs. They get soil-building properties and pesticidal reducing properties from the wild mustard and so it fits into the system. And this is what, again, we really need to look at and focus on in terms of dedicated energy crop production. Is how it fits in best into California's most diverse agricultural system in the world.

San Joaquin Valley opportunities, especially on the drainage-impaired lands where cotton was 1.2 million acres or even higher than that. Now about 300,000 acres this coming year maybe. So there are, there's still salty water that's -- brackish water that's available for use. Some fresh water available for use.

Westside Resource Conservation District is working on MegaFlora, which is a biomass tree that is salt-tolerant, drought-resistant. Some of the growers in Westside Resource Conservation

District are collaborating together on a nursery, on experimental plantings of the crop. Those could be used for second generation biofuels into biomass power plants.

Dairy manure, biogas from dairy lagoons. Taking some of that to then concentrate and make available in a more readily usable form organic nitrogen and offset some of the use of synthetic nitrogen in the agricultural system. All opportunities.

The last one, sugar cane production. In Imperial Valley Bryan Jenkins and I are finishing up a report that is delinquent to Western Growers Association on what we call virtual water, if you will. And the concept is right now Imperial Valley is transferring 200,000 acre/feet of water to San Diego. And in order to conserve that water they are fallowing land to do that.

What if they kept the water and grew an energy crop such as sugar cane, co-generated electricity and fuel ethanol. Can enough electricity be generated to send to San Diego so they can do ocean de-sal or some other sort of localized water development?

Well it depends on how efficient the

system is and we have laid out a number of assumptions and parameters. And it can be as bad up you apply eight or nine acre/feet of water and you get seven-tenths of an acre/foot of water on the other end in the urban sector. But it could be as good as applying five acre/feet of water and getting 20 acre/feet of water in the urban sector.

So the technology needs to be assessed and developed. Water management has to be refined on the urban side. But I think the initial study is showing at least there's an opportunity that really needs to be explored.

On-farm considerations just very briefly. It's got to work for the farmer. I'm almost done, thank you. So integrating into existing operations, ability to manage these new crops and technologies.

And when looking at the farm, USDA had a poster back in the early '80s on the integrated energy farm. And looking at it, for example dairies could put, have PV, could generate twice the biogas roughly if they had true access to the market. So an under-utilized resource that through policy and technology integration can really mushroom into much larger scale energy

production in my mind.

So again I mentioned I see us moving forward in a poly-fuel future. The technologies are going to compete and these workshops help inform us all in terms of developing the best policy and way to move forward. So thank you.

MR. McKINNEY: Great. Thank you very much, Steve. Commissioners, did you have any questions for Steve Shaffer?

PRESIDING MEMBER BOYD: No. Thanks, Steve.

MR. McKINNEY: Our next, our next speaker is professor Steve Shaffer at the University of California at Davis.

MR. SHAFFER: Steve Kaffka.

MR. McKINNEY: Steve Kaffka, I'm sorry. That's right, Steve Shaffer already spoke.

Professor Kaffka, professor of agronomy at UC Davis department of plant sciences, I think current co-director of the bioenergy working group. A long-time participant in helping the Energy Commission and other state entities understand the issues associated with agriculture, bioenergy crops and biomass issues.

And I just want to say personally as

somebody who is heading up the sustainability efforts for AB 118, Steve has really helped inform my thinking. He is very thoughtful and always has a good perspective to bear on pretty complex issues. So with that, Steve.

DR. KAFFKA: Thanks, Jim. Somehow my title slide didn't get here. I want to acknowledge Bryan Jenkins who had substantial input to this as well as some of our board members and members of the California Biomass Collaborative, Brian Williams, Bruce Goines, Doug Wickizer, who are board members, and others who I will mention as we go along.

I just wanted to put in just a brief plug and a description of the California Biomass Collaborative. A lot of the data, all of the data that you are going to see, comes from the efforts of the California Biomass Collaborative, which is funded by the PIER program through the Energy Commission and has been around since 2003.

It is an integrative organization that bridges we hope the entire sector of people, groups and interest groups that are interested in biomass energy. Basically it is a statewide coordinating group.

The data that we will be hearing or seeing today really comes in part from the California Biomass facilities Reporting System and from other database issues that are there. And you can go to the California Biomass website and get access to that data. That's one of its main goals.

It has also produced a roadmap to guide the development of sustainable biomass development in California and we are obviously active on the, as Steve kindly mentioned, on sustainability standards and with Commissioner Boyd's Interagency Working Group.

The biomass roadmap provides some guidance in developing recommendations on how to develop and use resources. It is for all users in the state. And currently the Collaborative is very much involved in trying to develop implementation plans in various ways for the roadmap.

I am just going to skip that.

Ken, in organizing this meeting sent us several questions and these are the questions that are there that he suggested that we at least think about. And I have tried to have these questions

inform the presentation that I am going to make. I won't tile talk very much about the Western Governors' Association task force. The speaker following me, Jim Schroeder, is going to talk about that. But I will try to touch on at least some aspects of these issues in the remaining time that I have.

Well you have seen this slide before. This comes from the database assembled by the Biomass Collaborative. This is the most recent set of data. We will be doing this again if we get funded in the next round for 2008 data and it shows both potentially, technically available and gross biomass estimates across the sectors. Other people have shown the slide as well.

One estimate that has now been submitted to the Energy Commission for their review shows one potential set of estimates for cellulosic residues in California. And they range from about 2.3 tons for residues from field and seed crops, orchard/vine prunings and so on. Landfills: mixed paper, landfills: wood and green waste with gas production, and then forest thinning. And I highlighted forest thinning because I knew there would be some additional interest in that. There

is a substantial ethanol production in terms of million gallons per year and in terms of million gallons of gasoline equivalence per year that come from these potential instruments.

Now the point is this is, these are not estimate of economically recoverable or even sustainably recoverable biomass but these are estimates of what is potentially out there.

Now some of our estimates that we currently have in fact still involve the idea of using agricultural crops for at least part of the biomass. And so one projection for the potential for corn production then, sugar beet production which is an excellent ethanol source, are these under E5.7, E10 and E20 blend scenario.

Now the ones that I have highlighted in pink, just looking at sugar beets, the 222,000 acres that are estimated, was the long-term average production in the history of the California sugar beet industry. Right now currently there's 20,000 acres of sugar beets in California. So some of these numbers are not terribly realistic.

And the same is true for corn ethanol. The 750,000 acres is almost all the corn produced

in California, including to feed all those 1.2 million dairy cows. So those numbers aren't particularly -- These need further refinement.

For oil seeds it's a little bit better. Under a B2 scenario, a biodiesel two percent biofuels, 180,000 acres of oil seeds is a realistic number in California, at least historically in agriculture. The other two numbers are potentially feasible but probably only as cover crops or secondary crops. Oil seeds being used as winter cover crops and other things.

But anyway, these are some of the numbers that are going into some of our long-term projections subject to revision.

Now this is a multi-feedstock scenario that has been developed for 2010 for the E10 and B2 scenarios. And it estimates that if you use ten percent of current starch and sugar crops for ethanol a third of the lignocellulosic residues, that includes from forest wastes. We'll talk about that in a minute. And perhaps as much as 200,000 acres of dedicated energy crops which could include grasses and it could include sugar cane ethanol, for example.

You could get to a fairly substantial

ethanol total in terms of greenhouse gas gallons of gasoline equivalent and it would be approximately sufficient to meet the 2010 E10 and B2 scenario goals. So there is some potential for this but we have to refine some of these extractable or achievable numbers.

Now what I am going to talk about for the majority of this presentation is recent work that has been submitted to the Energy Commission in a report that estimates the economically available biomass resource in California. It is a very interesting project. It was done by graduate students at UC Davis under Bryan Jenkins' supervision. Peter Tittmann, Nathan Parker and others.

And basically they are trying to do two things. They are trying to geographically map where in California biomass can be found and try to integrate that with the state's transportation and potential refining infrastructure. So it's another filter on the potential, recoverable biomass map.

And so this is basically just a picture schematic of the potential of the pathways that are analyzed in the biomass utilization and supply

chain. Obviously it started back here with wastes and from fields and forests and through transportation and refining to end users.

These are the materials that were considered. This is a modeling exercise. It integrates modeling using GIS methods with linear programming. It is basically a classical operations research transportation problem which is optimizing where you produce it and where you refine it and where you use it.

And these are the various sources that are considered in the various conversion technologies that are employed in doing the analysis. And these are the best guesses for the kinds of efficiencies associated with these conversion technologies for the year 2015. That is where the focus is.

This is what that bioenergy network diagram looks like. I know that we can't really study or analyze these diagrams in the presentation because it is too complicated and we don't have enough time for it. But they are up on the web and you can contact the Collaborative, Dr. Jenkins and myself, and we can go into that detail if you have further questions.

So this is one of the outcomes of that modeling. It provides the overview of the transportation network showing where there might be hubs in the transportation facilities. How material might be moved to various locations. So the green are the feedstock locations. You can see potential locations as well for manufacturing and then also some more substantial terminal locations.

These are -- This is breaking down the state in terms of transportation hubs or where you have blending facilities, existing blending facilities, and what the kind of fuelsheds that Steve just talked about might look like around the state, based on the modeling outcomes.

I wanted to talk a little bit about forest thinning because it's come up a little earlier. We met with some of our board members who -- California Collaborative board members who come from the forest industry or from the public agencies associated with forestry management.

And this is a draft partly developed by the Air Board based on data from the Biomass Collaborative and the Energy Commission and from the California Department of Forestry and Fire

Protection.

So it indicates what might be available in terms of technically available from slash and thinnings from forests, from mill wastes, from shrubs, meaning chaparral and shrub materials, adding up to a total from both private, federal and state sources.

Now the asterisks on the federal source is that those numbers are only calculated after all the federal parks, all the restricted and preserved areas, any area of federal public forest land that has any special consideration. The restriction is already removed and so this leaves, this is the extraction, potential extraction from the rest. And you can see that there's a number of roughly 14 million bone dry tons that's estimated when you do all these calculations.

Now some of the assumptions are that there's about 40 million acres of forest lands in California where about 46 percent is national forest, 12 percent is other public forests and 42 percent are private lands.

What do we mean by logging slash? Tops, branches and bark.

Thinnings are non-merchantable materials

extracted during stand improvement and for fuel reduction. This is for forest health management. And to reduce the threat of catastrophic wildfire.

The mill residues are things like bark, sawdust, shavings and trim ends.

And then shrubs and chaparral, that would be primarily for biomass.

Now both -- Oh you can't see that, I'm sorry, the background didn't come out. It's supposed to be black. But it says, both nationally and in California we are seeing a demonstrable increase of forest land burning each year. And we are also seeing an increase in the intensity of forest fires.

Now why is that? Well, the forest biomass, particularly in conifer forests, is increasing at rates greater than the harvest and the removal other than from fire. And that rate of increase greater than removal ranges from about 1.5 perhaps on private lands to as high as 15 to one. Now these numbers are not act in stone and they vary by location and area.

But when we build up so much fuel in our fires through caring for them so carefully, catastrophic fire becomes an outcome. And what

happens with catastrophic fires is that they fundamentally all end up undoing all the concerns that we might have for preserving the ecological values of our systems.

So these are some forest numbers and other biomass numbers that have come out of the modeling exercise by Tittmann and all. And what you see here is the annual potential production of biomass at a certain biomass procurement cost. And at above $20 a ton, at $15 to $20 a ton forest biomass starts to become fairly substantial. As well as municipal solid waste.

This is taking into account feedstock production, distribution to refining terminals and then distribution to end users. So this is a higher level filter, if you will, about economically recoverable biomass.

And at higher biomass prices above about, according to this modeling exercise $40 to $50 a ton, a substantial amount of forest biomass becomes available. And at around $100 a ton procurement cost you see the limit of forest biomass.

As discussed earlier, subject to all the constraints that currently exist on limiting

forest harvest, which includes policies to take into account the public trust doctrine and the preservation of ecological values in terms of forest stewardship.

So what happens? At less than $1.50 per gallon of gasoline equivalent the biopower provides market for about 14 percent of the biomass. We are looking at -- California has gone back up again but we were touching that again just recently. So you don't get much biofuel development around that. But above about $1.50 to especially $2 you see a rapid increase in the utilization of feedstocks in this model with costs centered around $20 to $35, $35 to $35 a dry ton.

Corn ethanol economically without subsidy enters at about $2.50 a gallon as does forest biomass. It doesn't say that in here. And by $5 a gallon gasoline equivalent you actually start to convert using a Fischer-Tropsch process, very low quality municipal solid waste into fuels. So there are economic thresholds that seem actually within sight. We could see perhaps $4 or $5 gasoline in our lifetimes again someday.

So if you take a look at these various sources as the price of biofuel in terms of

dollars per gallon gasoline equivalent increases you start to see some of these resources start to come into being and to use. So here is the forest residues. And somewhere between 1.75 and certainly 2.50 you see a substantial potential for the conversion of removable forest residues from -- and used for biomass. Provided you can figure a good lignocellulosic fermentation conversion. But these are the assumed costs of conversion that we can currently estimate.

Well this is very useful. This is useful just simply to show you that different types of materials, dry mill corn ethanol for example, has a much higher procurement cost than a conversion or distribution cost. Whereas electricity has a much higher -- If you are going to make electricity out of biomass it has a much higher conversion cost than feedstock procurement.

Fatty Acid Methyl Ester biodiesel and second generation biodiesel again have very large procurement costs relative to conversion. The Fischer-Tropsch diesel has a very high conversion cost with a very low procurement cost. So there's tradeoffs in all of these types of materials based on current technology assumptions.

So conclusions from this model are that depending on the market scenario the total economic biomass resource in the state varies between about 18 and 25 million dry tons at the price ranges of about $2.20 to $4. Now that's a lower number. You have been 30 to 40 million tons in some earlier assessments. But this is using the filter of actual looking at transportation and distribution costs and location.

However, this is the first cut at this, at this analysis. And to really know this on the ground, have a much better concrete estimate, we still do need to really do a better idea of the, of the mapping of the actual resources, a look at the sustainability issues associated with recovery and so on.

And we are going to need to do an analysis of the natural forest and carbon dynamics and wildfire frequency, which will change some of the, potentially change some of the assumptions around price and availability.

Land use policies are going to have a significant impact on the availability of feedstock. We heard earlier from the Air Board that they are not that interested in seeing

agricultural lands used for feedstocks. That's one policy, for example, that might reduce or change these availabilities.

We believe that land policies should enable the expansion of crops on marginal lands. I have talked about that at the Energy Commission previously and you can see references to that in some of the other locations on the Energy Commission website.

And we have the capacity to better analyze potential greenhouse gas reductions and so on through purpose-grown or dedicated energy crops and we think that those should be more thoroughly analyzed. So this is just a beginning and a start for this kind of work.

Now just briefly I want to talk about one of the last of Jim's questions is whether there's a potential for biofuels from purpose-grown crops in California.

Funded partially by the Energy Commission and also by the Air Board through the STEPS program we are conducting a much more detailed agro-ecological and economic assessment of the actual potential of biofuel and residue production across California's farming regions.

And I have listed a number of them there.

Steve Shaffer mentioned earlier that each region has separate sets of opportunities and constraints. So if you were to do a simple statewide calculation, which is what we have tended to do in the past, you are going to both over- and underestimate biomass production.

And these models, which we have already started to create, can be used for a number of purposes. In fact we are doing it in cooperation with the Bren School with another Energy Commission project as well.

These are roughly some of the areas that are being analyzed, both as areas, as regions as a whole but also within subregions of those, of those large areas.

We are taking a look at the most likely crops, which are the ones that we know how to grow right away, but also some perennial forest grasses and perhaps some other new species that might be introduced.

And this just gives you a snapshot of just some of the numbers. These numbers come from interviews with individual farmers. The farmers have chosen -- the people in the Cooperative

Extension who know their farmer client base and who suggested that these would be the best people to interview in this area. So we are going around the state and interviewing them.

And if you just take a look at alfalfa across the stop you see cost and return estimates for the San Joaquin Valley for 2008 for the cost of production of alfalfa but you can see the estimates of the individual farmers based on the records that they gave us. You can see that it varies quite a bit. And in parentheses is the percentage of the cost due to water allocation. And that's interesting to because look at Farmer 6. His water cost is way lower than Farmer number 7 and Farmer number 4, even 5.

So even within regions, this is just Western San Joaquin Valley, there are these quite distinctive differences for both opportunities and constraints for production.

Basically -- I'll skip that. That's a model and the simple way it functions.

This shows you for Farmer number 5, our estimates of his costs and returns for different crops. And you can see in the first one canola, which is a new energy, potential energy crop,

starts to replace both a little bit of tomato-processing and pima cotton at a fairly high price of $20 a hundredweight. That's higher than we are likely to see for biodiesel so that doesn't seem too promising.

But sweet sorghum looks actually quite reasonable at the price of around $18. At $17, $18 a ton for biomass it starts to replace some alfalfa hay production in that case on that farm and some processing tomatoes. And certainly pima cotton.

This is where we have the interviews conducted so far, we have got another 10 to 15 to do. And you can see the entry point into the crop rotation for canola. You can see how that price varies by different farmers. And you can see how the price varies as well for sweet sorghum. In some cases by almost three-fold. So this gives you an idea of the kind of information that is coming out of this work.

This same kind of information needs to be done for the assessment of forest biomass resources and their availability. And it is part of the next phase of the Collaborative's projects should it be funded.

Just lastly I want to mention, just point out that there is potential, and it is not in the model that I just showed you yet, for the use of crops for phyto-remediation or bioremediation of problems like selenium. And I have talked about this at other presentations at the Energy Commission so I won't cover it in any detail here. But this represents a way of using bioenergy to try to manage other environmental problems. In other words, fund, provide economic resources to do environmental management of something like selenium on the western side of the San Joaquin Valley.

So I probably went too long I'm sure but that's it.

MR. McKINNEY: Thanks very much, Steve, and I want to acknowledge that I actually asked him to cover a few additional items so I'll take the responsibility for him running a little long. Commissioners, did you have any questions for Professor Kaffka?

PRESIDING MEMBER BOYD: I don't know if it's a question or a reaction. Maybe it's a question. I was frankly surprised by the amount of stover referenced in your chart, if I take that

as a California fuel base. And that gets back to an earlier comment you made about the amount of corn in California. A little bit more than I am used to recalling.

DR. KAFFKA: Well we tend to think of corn in two ways, one is corn grain and one is corn silage. And the great majority of corn produced in California is grown to feed dairy cows. It's like seven to eight to one is the ratio.

Stover is available in straw. There's quite a bit of wheat produced and quite a bit of wheat straw, barley straw and so on. That is also part of what you would call stover.

PRESIDING MEMBER BOYD: That's my mistake, I'm only thinking of corn stover.

DR. KAFFKA: If there isn't any, if there is a severe water limitation then what happens is this. You see corn stover baled up to feed the dairy cows because there is not enough water at a minimum baseline to provide enough feed. So there's a bunch of public policy issues that interact with all of these numbers.

MR. McKINNEY: Any other questions from the Commissioners?

Before I introduce the next speaker -- And thanks again, Professor Kaffka. Before I introduce the next speaker, I was made aware of a program change. So Alan Weber, stand by and be prepared to make your presentation after Alex.

Our next speaker is Alex Schroeder. Alex is the program director for the transportation fuels and radioactive waste transportation with the Western Governors' Association. And he has been in the Denver office for four years. So welcome Alex.

MR. SCHROEDER: Thank you, Jim. I would also like to thank the Commission for inviting the Western Governors' Association and allowing us to attend and participate in this workshop.

I realize that I may be the last speaker standing between everyone here and lunch so I will try to be efficient here.

A little bit about WGA. We represent the 19 western United States and three US Pacific flagged islands. You can see our territory there. It's a good deal of the country. Currently right now our Chair is Governor Huntsman of Utah and our Vice Chair is Governor Schweitzer of Montana. The chairmanship rotates every year and our chair also

hosts our annual meeting, which will be this year in Park City, Utah.

WGA was really established by the Governors as a regional forum to work in issues that have a regional underpinning. A lot of those have come up and energy is an obvious one. Natural resources, forest health.

And it is really an opportunity for the governors to get together to come up with a common western voice. There are definitely some unique western concerns that the Governors feel need to be addressed, both within the states and in Washington. And we work to provide that forum.

I guess a little background on how we work and how we get our direction. The Governors establish policy resolutions, typically every year at their annual meeting. The policy resolutions are driven by the Governors. They are typically reached by consensus and it is really what gives staff direction on our work plans.

I am really here to talk about two specific programs. One is the Transportation Fuels for the Future initiative, one which Commissioner Boys is very intimately familiar with as one of our co-chairs. The other is a Western

Strategic Bioenergy Assessment, which is really kind of an expansion of the program Steve talked about. Looking at the whole supply chain for biofuels across the entire West.

I would also note the quote at the top, which comes from a recent letter from the Governors to President-elect Obama. And it really, this post-dates both of these reports and I think underscores the Governors' commitment to working together and working with Washington to kind of work through some of our energy issues.

So the Transportation Fuels for the Future resolution was passed in 2006 and added on the establishment of a regional task force. The regional task force was charged with coming up with policy recommendations to increase the recent supply -- excuse me -- the capacity of alternative fuels, develop an adequate infrastructure to support that, and position the Western States as key producers in the alternative fuels economy.

Just kind of to jump ahead. Some of the cost-cutting recommendations that came out of the report were leadership, environmental stewardship, financial and economic support, infrastructure, feedstock development and workforce development.

Just to get into a couple of these specifically. I think the Advisory Committee which wrote this report really realized that the states have the leadership role to play here. There's a lot that the Governors can be doing, the states can be doing, state agencies, et cetera, to kind of advance the region's alternative fuels agenda, whether it be fleets, et cetera.

Environmental stewardship is obviously a chief concern of the Governors and working together regionally to solve some of these issues I think was an important point the Advisory Committee stressed.

Our infrastructure challenges are obvious and there is certainly a need for regional cooperation there. And I think as we will hear in the afternoon as we have heard this morning, there are certainly challenges in getting both feedstock development technologies, conversion technologies and also the workforce to support that.

Specifically advising the Advisory Committee was a biofuels task force which I think was referred to earlier. And it was really, it was a broad stakeholder group and they made recommendations to the Advisory Committee, which

then went forward to the Governors. And I will just talk briefly I guess about some of their priority recommendations.

One of them which I think was accomplished -- And we'll also note that this report was published before the Renewable Fuels Standard. So the first one which is really a priority recommendation was creating a demand for biofuels. I think we can check the box. There are certainly some things that probably, some ways to tweak that but really the basic policy is in place.

Another was coordination between state and federal agencies on research, development and deployment and really kind of making sure that state and federal incentives and programs were working with each other and not against each other.

Another thing that has been talked about several times today is ensuring that the next generation of biofuels is developed, whether it's developing feedstocks, dedicated energy crops and also the conversion technologies so we can move to the next generation of biofuels development.

And lastly development of infrastructure

to support higher blends of biofuels. And there are different ways that the different states are looking at this. In the Mid-West blending pumps are extremely popular and there are certainly regulatory considerations there. But there was just a general recognition that regionally we need to be working together on some of these infrastructure challenges. Which again is pointed out below.

I think it was mentioned before, coordinating fuel standards. Air quality standards across state lines are going to be essential. As Bob pointed out in the Low-Carbon Fuel Standard, it's really important that state policies really move past the borders because a lot of the economic implications don't have borders. So it is really important that we, we work together as a region.

And the same goes with environmental impacts. Emissions, water, et cetera don't necessarily have state borders.

So in conclusion of this effort the Governors passed a resolution in 2008 vowing to work together on the recommendations.

And they also formed a Transportation

Fuels Council which really has been given that task, and they are going to be reporting back to the Governors this year at their 2009 annual meeting on some of the progress that the Western States made.

It is also an opportunity for the states to get together to kind of share experiences, coordinate with the federal government and have kind of a regional forum to share what's going on in each irrespective states in regard to alternative fuels.

So moving on to the Western Strategic Bioenergy Assessment, which as I said is really kind of our expansion of the work that UC Davis did. And we would like to acknowledge and thank UC Davis, they have been a great partner to WGA. Bryan Jenkins has probably actually been working with WGA a little longer than I have.

And really there were four parts to this assessment, which Steve kind of alluded to. And the main goal is really to get an idea of the entire biofuel supply chain so we have an idea of what is economically feasible. The first part is really looking at the western resources. Coming up with an inventory of our biomass resources.

The second is modeling the conversion technologies. And the part where UC Davis really helped out was plugging that into a model with the transportation infrastructure that could really come up with a delivered cost of fuel.

And the fourth piece was kind of an analysis that we used to inform the biofuels task force and also the Advisory Committee report which was looking at what different policies could be put in place and could have a positive effect on the outcome here.

So this is just a brief overview of the results. These are potential growth projections to 2015. I will note that this is modeled at a $2.40 gallon of gasoline equivalent price, which at the time was very reasonable, six months later it was not and is now high. So it's definitely a moving target.

But the main conclusion was that 11 billion gallons of biodiesel and biofuels are possible per year by 2015. You can kind of see the breakout of feedstocks on the right. This obviously assumes a big increase in production with cellulosic biofuels, particularly from herbaceous energy crops.

And this translates to roughly $18 billion in economic development in rural communities and a $23 billion investment in technology and infrastructure.

So the next step, and this is what we're currently working on right now, is taking this Western model and making it a national model. The fuels market is really something that doesn't have any boundaries, unlike electricity where there are street grids. It's really a national market. Feedstocks certainly cross borders.

So the US Department of Energy approached us on taking our model, expanding it nationally and really using it to provide a key input into their update on the Billion Ton Study. So we are working with them right now. We are revising a lot of our western data on feedstocks. Kind of looking at the conversion technologies, reevaluating those, seeing what else is possible.

And I think a big piece that we are looking at here is a more detailed look at environmental impacts. And what those, going back to the western assessment, what does 11 billion gallons of biofuels mean for greenhouse gas emissions, for water consumption. And really

trying to come up with some of the secondary or maybe even primary impacts of ramping up for biofuels production.

We are also looking at modeling different national policies and infrastructure scenarios. One would be a more distributed infrastructure where you do have blending pumps instead of centralized distribution facilities. Also potentially looking at the effects of a cap and trade program price on carbon, et cetera.

And of course as I mentioned before, the price of gasoline is certainly a moving target. We hope to update some of our economic assumptions on that.

And finally, I think we are looking to make this information available in a manner that is easily accessible to everyone. So that it is useful to the consumer, it is useful to businesses. But just kind of getting that information out there and making this work publicly available.

So I will just briefly go over some of the things that WGA plans on working on in the coming years. I just mentioned our National Bioenergy Assessment. We hope to have it wrapped

up by the end of this year.

We are also hosting regional biofuels workshops, really as an opportunity to kind of get states together to evaluate their biofuels policy and also bring in federal agencies and start a dialogue there.

WGA is also a member of the National Biomass Partnership and we work with the other Governors' organization in the country to just kind of make people aware of what is going on in biofuels in Washington and kind of create a national network there.

As I already mentioned before the WGS Transportation Fuels Council will be presenting their progress report to the Governors at their 2009 annual meeting.

I think I briefly mentioned in our third slide the Governors are following up with President-elect Obama, the Administration and Congress on a letter that they sent in November which really emphasizes the need for a comprehensive, national energy policy.

And as I said, this is something that WGA has really been pushing for quite a few years. I think there is a sense that it is really

reaching ahead and a sense of urgency. So the Governors are exploring ways to implement that. They met with the transition team in November, provided testimony in Congress, and we are really looking at ways to kind of make sure that the western states are at the table.

I think that's about it so are there any questions?

PRESIDING MEMBER BOYD: Thank you, Alex.

MR. McKINNEY: Our next and final speaker for this panel is going to be Alan Weber. And Alan is with the National Biodiesel Board. And I'm sorry, Alan, I didn't get a chance to talk to you before so I am going to ask you to introduce yourself. Are you with us here?

MR. WEBER: Yes I am.

MR. McKINNEY: Can you work the controls okay?

MR. WEBER: I believe so.

MR. McKINNEY: Great. Okay, have at it.

MR. WEBER: Very good. I seem to be having a delay on advancing the slides.

MR. NGUYEN: Just click your mouse on the slides. Maximize it, please. The red arrow at the bottom, the left hand corner. Thank you.

MR. WEBER: Then to advance do I click on it?

MR. NGUYEN: Yes.

MR. WEBER: I'm not having a response.

MR. NGUYEN: The up and down arrows. Click your mouse on the slide and then the up and down arrows.

MR. WEBER: Nothing.

MR. McKINNEY: Alan, Jim McKinney. I'll tell you what, why don't you make your presentation. And then when you want a new slide say, next slide please, and Darren will operate it from here.

MR. WEBER: Very good, that will work from this end. And thank you Jim and thanks for working with me in terms of getting technology to work. I do, I do appreciate the chance so Commissioners Boyd, Douglas and the rest of the Committee, I appreciate the opportunity to be able to be with you via the web today to present before the Committee.

For the record my name is Alan Weber. I am a partner with MARC-IV Consulting and also serve as a senior advisor to the National Biodiesel Board. What I hope to accomplish today

is to provide you with an overview in terms of sources which are available to utilize for biodiesel production in the United States. Next slide, please.

I am representing the National Biodiesel Board. Some of you may already be familiar with this organization. In case you are not, the Biodiesel Board is an industry trade association. It is very diverse in terms of membership, representing most every biodiesel producer that is in the United States, also fuel marketers and technology firms as well as feedstock organizations. So offices, our headquarters in Jefferson City, Missouri and also offices in Washington DC. Is it possible to get the slide advanced?

MR. McKINNEY: Bear with us, Alan, we are still figuring this out.

MR. WEBER: I'll just go ahead and move forward. I know the Committee is aware of a lot of advances in biofuel as well as biodiesel. We have seen some significant industry growth moving from a mere two million gallons in the calendar year 2000 to the most recent year in which we will see about 700 million gallons of biodiesel which

is being produced by US producers.

And I think it is important from the context of looking at this growth in terms of some policy which is has been set at the federal level or whether we are looking at it from a California-specific standpoint in terms of this growth and some of the milestones which have been set.

And when we start talking about policy and milestones which have been set there's a couple of questions which come to the forefront. A lot of times the first question is, will there be sufficient investment in terms of plant capacity? And then with biodiesel specifically the next question usually comes to be, you know, will there be sufficient feedstocks to be able to meet these goals or these milestones?

And what I wanted to do in the presentation today was to address both of those questions. I set a benchmark of 2012, primarily because some of the federal legislation which you heard speak about earlier, the RFS 2, and the fact that that 2012 date is a milestone date.

Whenever the slides get to it there is a slide in terms of production locations in terms of plants that are in the United States. Valentino

earlier provided an overview of California and so from a US perspective as of September of last year there was around 175 plants with an annual plant capacity of around 2.5 billion gallons.

And for those of you that might have had an interest, the average plant capacity is around 50 million gallons currently. And 42 of those 175 plants are a 20 million gallon per year plant or greater. And in addition to those plants, which I might mention kind of stretch across the West Coast north to south, there's a number of firms that still have plans for expansion or for new construction. And when those plants are taken into consideration you would have an additional 850 million gallons worth of capacity which could be brought on-line if all of those plants materialized.

More from a state perspective. Texas and Iowa lead the way in terms of states that have invested in plant capacity. Texas has 450 million gallons of annual plant capacity. Iowa follows with greater than 300 million gallons of plant capacity. And when you take a look at the West Coast and look at California, Oregon and Washington, around 160 gallons worth of plant

capacity. The numbers matched up fairly well actually with what was presented earlier.

Kind of shifting gears. From my perspective I don't necessarily believe that a certain plant capacity represents a constraint for federal policy or for state policy as far as that goes as well. But I do want to shift gears then into looking at some of the feedstock supplies.

And I think that whenever think about feedstock supplies it is important to be able to divide our thoughts up from a timing perspective. So I wanted to speak first of all in terms of the near-term landscape. Where we might see opportunities for feedstock supplies in the three or four years. And then look to the horizon about other opportunities which I believe are out there.

Whenever we think about raw material supplies, and I'm speaking for the US as a whole. We have gone from California-specific to the western region and now we are looking at the nation as a whole. We will be relying, in my estimation, on some of our near-term technologies. Some things that you are probably familiar with. Things such as yellow grease, animal fats, canola, Nebraska (indiscernible), soybean production.

And there's some things which you may or may not be familiar with, things such as Camelina production possibly in the Pacific Northwest, or utilizing corn oil in ethanol plants in the US.

So using 2012 as a benchmark I am going to go through some of these opportunities and try to give you my estimate of where I think raw material sources will be in the year 2012.

So kicking things off I am actually going to start with the ethanol industry. It is important in my mind to feel the leverage opportunities wherever they exist. And as Paul had indicated earlier, with the RFS 2 goal of having 5 billion gallons of starch-based ethanol by the year 2015 -- realize we are talking, give or take, around five billion of corn, which would then be converted into ethanol.

And although the amount of fat that exists in a kernel of corn is low on a percentage basis, when you think about the volume of bushels we are actually talking about a very significant amount of potential vegetable oil.

To be able to extract that oil we are really looking at two pathways. The first pathway would be on the front end of the ethanol plant

looking at fractionation technology. The other would be to actually go through the fermentation process and then to de-oil one of the co-products, the dry composed grain from solubles, to pull that vegetable oil out.

And we termed the adoption of these technologies with the current capital markets the way that they exist today as well as the amount of capital which is required to be able to, you know, look at fractionation technologies. It is my opinion that most ethanol plants that will be looking at adopting a pathway will be looking at a de-oiling technology. Which has the capability, most likely, of removing about a third of the potential oil.

So when you think of it from that perspective of removing about a third of the oil of five billion bushels of corn, it is around 400 million gallons worth of biodiesel potentially if vegetable oils could move into the marketplace.

I think it is also important to note, to highlight that the current vegetable oil content of corn is between three and three and a half percent. And technology already exists in terms of genetics to be able to almost double that up to

close to seven percent for some Iowa corn.

On my screen, to Jim or to Darren, I'm still seeing the initial slide. Is the rest of the Committee seeing other slides?

MR. McKINNEY: Yes. The WebEx is not working for your presentation and we really apologize for that, Alan. We are trying to page through the slides here at the Energy Commission.

MR. WEBER: Okay.

MR. McKINNEY: But there seems to be a bit of a glitch there. So the one I have got up here is Near Term Raw Material Sources.

MR. WEBER: Okay, you can go ahead and move two more past that.

MR. McKINNEY: Dry Grind Ethanol Plans?

MR. WEBER: A-ha, and then move to the next one.

MR. McKINNEY: Camelina?

MR. WEBER: Yes sir.

MR. McKINNEY: Bingo.

MR. WEBER: And so we just basically looked at the potential for pulling vegetable oil or feedstock supplies in ethanol plants.

And I wanted to switch gears and talk about some of the higher oil content oil feeds.

Let's start with Camelina which is a crop which I think more people are becoming familiar with. It's a relatively input crop and concentrated right now in Montana and other parts of the Pacific Northwest.

If you take a look at an eight state region in that area there's around 22 million acres worth of wheat grown. So it is realistic to think that maybe we would be able to plant on ten percent of those acres, or around two million acres, camelina. And if successful that would represent about 116 million gallons worth of additional feedstock supply.

Keeping in mind that one of the benefits of camelina is that it can be grown on acreage which maybe doesn't have the potential to raise a good canola or a good wheat crop. So I think that two million acre target is realistic, timing of course with the issue there as to when the two million acres would be realized. Introducing a new crop is not easy. I have had one in a decade of experience of introducing new oil feeds and material green crops.

The challenges in this case are several. Risk management options for farmers, things like

getting crop insurance. Grower education about how to move it into the rotation. And most importantly, just the fact that it would have to compete with crops that might be in a rotation from an economic standpoint. So in this case that would be wheat. But nevertheless, it was realized in the Pacific Northwest where you are looking at more than 100 million gallons of additional feedstock supply.

So moving to the next slide in terms of winter canola. And most of the canola acreage which is grown in the United States currently is raised in the upper Midwest, primarily North Dakota. About a million acres in that region, almost all of it in spring canola.

There's a lot of opportunities in being able to look at planting winter canola in new regions. That would be the Great Plains, the Mid-South or Southeast and then also the Pacific Northwest.

The US Canola Association has a goal, a stated goal of increased acreage to two million acres by 2010. Again, some of the same challenges persist in terms of increasing acreage. Things such as risk management strategies, having access

to crop insurance. And again, that crop must compete competitively. But if we added two million acres of canola it represents about 100 million gallons worth of additional vegetable oil supply.

I do think it is important to note that even though we do have plants in the United States which are currently operating on canola feedstocks it is a premium priced feedstock and therefore most likely would move into the edible oil market. But still benefiting the biodiesel industry from the standpoint of increasing vegetable oil supply.

In the next slide I wanted to highlight some of the opportunities for animal fats and yellow grease. And although these feedstocks don't necessarily have a supply response, we don't necessarily eat more french fries to generate more recycled cooking oil, I do believe that they will have a significant contribution in terms of raw materials by 2012.

So basically some information on work that was done and commissioned by the National Renewable Energy Laboratory which estimated the per capita generation of recycled cooking oil at about 9.4 pounds per capita. In a total sense in

the US we could probably generate around 300 million gallons worth of yellow grease.

Now it is not realistic necessarily to assume that all of that would be diverted into biodiesel production. There's a lot of other uses currently, primarily in terms of feed manufacturing for yellow grease.

I do have, however, think that as you look at the import/export data that we realize that about half of our inedible fats are currently exported that we could assume we could probably divert up to half of our yellow grease generation into biodiesel production. So, you know, representing a little bit more than 150 million gallons worth of potential.

Switching over to the animal fat side, to the edible/inedible tallows, the (indiscernible) greases, poultry fat. Using the US census information there's around 964 million gallons worth of potential in the form of animal fats that are currently being rendered.

Now again these feedstocks currently have uses and so (indiscernible) be able to put them into biodiesel production. So some industry analysts have felt that moving up to 25 percent of

existing animal fats into biodiesel production would be reasonable, thus representing around 250 to 260 million gallons of potential production.

And then kind of finishing up here in terms of the near-term opportunities looking at soybean oil supplies on the next slide. Just to kind of benchmark for you: In 2007 and 2008 around 400 million gallons worth of soybean oil were utilized in biodiesel production. The '08 crop this past year was around 2.92, 2.96 billion so a fairly healthy crop.

And I think the most notable thing that would be of interest to this Committee is the fact that companies such as Pioneer and DuPont Company and Monsanto have been investing significant resources to be able to improve today. And with limited introduction in '09 and full introduction in 2010, we will see genetics that will have a stepwise change in yields of ten percent.

And when we think about the fact that farmers have demonstrated the willingness to adopt technology or genetics, which will have unit improvements or cost reductions. So if 90 percent of reductions, say 60 million acres were converted to the next technologies and new genetics, that

could actually add around 250 million bushels or close to 380 million gallons of additional oil supply on the soybean side.

If we move to the next slide it kind of provides a summary that whenever I look at feedstock supplies for biodiesel production in the next three to four years, so by 2012, we are looking at a possibility of around 1.8 billion gallons worth of potential.

Now I think some important things to note here. The first one is that these are all known technologies. So all the things which I discussed, currently -- the technology currently exists to process it.

But any new crops, in terms of introductions, does have its challenges, which I tried to note. I also highlighted the fact that we would have yield enhancing technology on the soybean side. But I want you to remember that we can have production of additional bushels but we would have to be able to expand our processing capacity at the same time to be able to utilize the oil.

And to be able to fully benefit from the potential corn oil coming from an ethanol dry

grind facility we have to also assume that the capital markets are there to be able to have those investments. So there are some blocks out there but I think from a near-term perspective we can see up to 1.8 billion gallons worth of fats and oils.

The thing which I didn't cover but I just wanted to highlight is when you start thinking about soybean oil exports, the export of raw soybeans, the potential for import of other feedstocks, whether it be things such as palm or whether it be other vegetable oil supplies coming from other countries. It could have a significant but it's highly variable depending upon the global economic conditions as well as policy. And heavily dependant upon expansion of processing facilities here in the United States.

So what is on the horizon? Trying to look at it more from a perspective of looking at California and crops which could potentially be grown in California. If we move two slides forward, please.

You currently, when we take a look at raw material supplies in the US there has been a lot of competition for feedstock by the biodiesel

facilities, margin is a bit thin. But the silver lining from my perspective, and then from the fact that there has been a lot of investment is in feedstocks and looking at ways to deal with increased feedstock supply. So we will be speaking about a lot of things that include halophytes such as Pickleweed and Seashore Mallow, crops such as Jatropha, Pennycress in the Midwest, Low Ricin Castor. All of these have potential. But I did want to more concentrate on things which may have potential to California.

So if we could move to the next slide. Algae is a technology which probably has some of the most significant potential in terms of yields per acre. I think that it could realistically -- researchers and companies which are working right now are estimating a two to five thousand gallons per acre range in their discussion, with a lot of research going into ways to be able to increase that significantly.

You know, I was at a (indiscernible) exercise for algae last month. And a note that I thought was interesting was that in terms of venture capital investment in the first and second quarter of 2008, around $280 million was invested

in biofuels and of that, 84 was specifically for algae. So algae is garnering a lot of attention from an investment perspective.

In speaking with companies that are working on the development side, they said it is probably reasonable to assume that we would be able to see commercial fuel production in the next five years.

Brown grease. The only thing I wanted to add from a brown grease perspective. Again, the potential. You're looking at close to a half a million gallons potential based upon the work that was done for an NREL report in the late 1990s.

And the last thing I wanted to say from a brown grease perspective is just the fact that even though I have it on the longer term horizon, I did so full well knowing that California's codes are already firm which are actually plugging brown grease conversion into biodiesel. So it has the possibility of having a greater capacity in a shorter time frame.

The last two slides I just want to briefly mention due to the time constraints. Jatropha is a crop which can be grown on less-than

optimum acreage. It grows in various low rainfall areas. Up to 40 percent oil, typically 35 percent. This is a crop that hasn't had a lot of research into it necessarily. It currently cannot be mechanically harvested. And it does do better, obviously, with better ground. Primarily being grown in Asia but some acreage being planted in Central America as well as Africa.

And the last crop to highlight that has potentials in my mind for the state of California would be halophyte production. Which is a crop that can thrive in high-salt content environments, whether it's brackish wells, wherever you have salt water intrusion. These would be crops such as Salicornia and Seashore Mallow. But the main thing I would emphasize here is that all of these crops need a lot of work, a lot of investment on the user side. Everything from genetics all the way through to the processing.

So in summary. Thank you for staying with me through the presentation here.

When I think about plant capacity I think about feedstock potential, keeping in mind the 2012 benchmark which I outlined. I don't believe that plant capacity nor feedstock supply,

from a US level, represents constraints to be able to meet a federal policy such as RFS 2, and also the state policies such as being considered in California as well.

So Jim and the Committee present, thank you again for the opportunity to be able to present to you. And with that I will conclude.

MR. McKINNEY: Thank you very much, Alan. And I also want to say thank you very much to Darren for helping us get across the technological thin ice there on the presentations, thanks.

Commissioners, any questions for Mr. Weber?

PRESIDING MEMBER BOYD: None, thank you.

MR. McKINNEY: I think in terms of moving to the next step. I know we are trying to maintain our schedule. I suggest to the Committee that we get a show of hands to get a sense for how many people want to speak or ask questions on the four panelists who have already presented this morning. I don't see any.

Darren, are there any people on the WebEx who want to pose questions?

Does anybody on the phone want to pose a question to our panelists?

MR. SHIPLEY: Yes, I would like to pose a question for Mr. Weber.

MR. McKINNEY: Will you identify yourself, please.

MR. SHIPLEY: This is Greg Shipley calling. I'd like to ask Mr. Weber to repeat some of the statistics on the algae and what the production yield was.

MR. WEBER: Yes, Mr. Shipley, this is Alan Weber. From an algae perspective there is -- If you were to attend an algae conference where there were five firms and they were speaking about their technology there would be a very wide range in terms of projections of production per acre.

I think that a number of individuals, when you think about what is doable today, (indiscernible), that in the range of two to five thousand gallons per acre would be something that would be achievable in the next few years.

I realize that there are number of research programs looking at things such as frequency shifting of light, heterotrophic boosts in terms of growing the algae in the evenings and

increasing the CO2 fixation rates that could double and triple that potential.

I guess throughout my presentation, as you can see, even with the animal fats and yellow greases, I am not assuming that we can take all of the production into biodiesel. I am trying to be realistic and to be conservative. So that is why I gave the two to five thousand gallons per acre.

MR. McKINNEY: Thanks Alan. Any other questions from the WebEx audience?

MR. RAIN: Yes, my name is Rain. I was wondering if there has been an looking into doubling algae production with water treatment?

MR. WEBER: Yes, this is Alan Weber. And Rain, I guess a lot of individuals would definitely point to water treatment abilities as a very likely first impact into the marketplace. And I think in that particular case where you have got the nutrient loading that what it does is really help from an economic perspective in terms of the amount of nitrogen and phosphorous or other nutrients which would be required (indiscernible).

MR. RAIN: Absolutely. Thank you.

MR. McKINNEY: Rain, we are really glad that you are joining us today. And I just wanted

to ask, have you composed any songs about the wonders of algae as a biofuel?

MR. RAIN: No, actually I have not.

MR. McKINNEY: When you do please send us a copy, okay.

MR. RAIN: I appreciate that, thank you.

MR. McKINNEY: Any other questions from the WebEx audience?

I think with that, Commissioners and Ken, I'll turn it back over to you and let you decide how long you want to break for lunch.

PRESIDING MEMBER BOYD: Well, okay, a quick announcement then we'll break for lunch.

Item number six on our agenda for this afternoon is titled Company Presentations. What we would like all of you to think about when you come back from lunch is to fill out one of these blue cards that's on the table out there in the lobby. This is a request to speak.

As you heard at the beginning, we are limiting folks to five minutes, no slides. But please do sign up if you want to make a presentation and put in the upper right hand corner where there's no space but up in the right hand corner that it is a company presentation so

it can be correlated back to the agenda.

With that I think we will break for no more than one hour for lunch. We are going to start right on time so I ask you to hustle quick. Come back and we'll have to move smartly. This is really interesting and I hate to move things along but we are going to run out of day here. Thank you all.

(Whereupon, the lunch recess was taken.)

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AFTERNOON SESSION

DR. TIANGCO: Good afternoon. Welcome to this afternoon's biofuels technology workshop. We have a daunting task. This afternoon's session is on the conversion technology.

The transformational breakthrough in basic, including applied and demonstration of technologies that will be necessary to make plants for biomass, for biofuels to be economically viable.

For example, one of the key barriers, one of the key barriers is the recalcitrant or resistance of plant fiber to break down into sugar, intermediate. The scientific and technological challenges here are formidable. Significant work is needed to better understand the science for -- including plant cellulose, plant fiber, for converting lignocellulosic biomass to ethanol.

Likewise another key barrier to understand how plant material breaks down thermochemically or thermally, there is a potential for new progress in chemical, thermochemical conversion processes to include catalysts. In short, we need technological

breakthroughs in order to help meet the biofuel targets that we have here in the state.

This morning I alluded to the current biofuel production. If you look on our current biofuel production, by 2010 we will be able to meet the 20 percent biofuel production in the state. Before the idle power plants will operate on-line by the end of this year or early next year we will be able to meet the goal of .3 billion gallons capacity equivalent of diesel biofuel.

This afternoon's session on biofuel production technology. We have six speakers, we have six distinguished speakers here. The first two speakers will be doing it on-line by WebEx. We have Dr. Don Stevens who will share to us the up-to-date information on biochemical conversion processes.

We have Dr. John Scahill from Denver, Colorado who will be doing it on-line also on thermochemical conversion processes. Dr. Bryan Jenkins will share the Chevron - UC Davis Research. And Harvey Blanch from Joint BioEnergy Institute will share their progress on what to date has been done in JBEI research. Together with Susan Jenkins who will be showing to us the

Energy Biosciences Institute research being funded by BP. And last but not least Tom Jacob will say something on the biobutanols and all the other lignocellulosic biomass projects, what they have been doing to this point.

Without too much ado I would like to give the floor to Don Stevens from the Pacific Northwest National Lab. Don, are you on-line?

DR. STEVENS: Yes, I'm here. Can you hear me now?

DR. TIANGCO: Yes, loud and clear.

DR. STEVENS: Good. I appreciate the offer to be part of your conference. I appreciate the offer to do this by WebEx. The global CO2 imprint attributable to this conference is less because I don't have to be on a jet coming down so I appreciate that.

I'd like to talk just a little bit today about the biochemical conversion work. And I have here as well Dr. John Magnusson from PNNL. If there's questions that one of us can't answer the other one hopefully can.

Just as a way of benchmarking where we are right now, essentially all of the biofuels which are being produced, the vast majority of it

at least in terms of volume, is ethanol and that's produced from corn. There's of course biodiesel as well, it's a smaller amount. But nationally we are producing the vast majority of our biofuel and ethanol from corn.

And with the plants that are currently available and the ones that are either under construction or being planned, we will rapidly be getting up to the 15 to 16 billion gallons nationally of biofuels. That brings us to the energy impact of the -- what the Energy Security Act's guidelines for corn ethanol. So ethanol as a fuel in this country has grown dramatically. That's not news to anybody.

Going to the next slide though. If we are going to move ahead we are probably going to get away from corn and go into the lignocellulosic feedstocks.

If you look at the national resource base you can kind of project out that various amounts of biofuels could be made from the various kinds of crops there, the various kinds of feedstocks. And that corn will still continue to be part of that but the majority in the future will shift away from just corn to include a

variety of biomass feedstocks. And those of course include things that California as well as Washington here has, ag residues, forest residues, municipal waste derived from feedstocks, et cetera, et cetera.

And one of the things that we did at the lab here at a few years ago was look at feedstocks. And if you get out of the Midwest where there's lot and lots of corn stover and go to the West where there isn't lots and lots of corn stover, what you find is that you are going to have to use a lot of different feedstocks. You are going to have to use things from a lot of little different piles.

In Washington it's everywhere from food processing waste to grape pomace to this and that and the next thing. And California if it wants to have its fuels come from indigenous resources as well is going to have to look at that vast variety and diversity of feedstocks.

If you look at all those feedstocks and think about how you do it of course there's a couple of different pathways. John Scahill is going to talk about the thermoconversion in a minute. I am talking about the bioconversion

here.

And for the most part bioconversion requires that you recover the sugars from the plant material and you let the organisms convert them into something interesting. Ethanol certainly, maybe other things as well, we'll get to that in a minute. And in doing that you have to somehow take advantage of the lignin that is there if you don't want a whole bunch of lignins just sitting on the ground wasting away.

There's also the whole issue of lipid oils, particularly from algae, whether we consider that bioconversion or feedstock. We'll talk about that in a minute.

A biological conversion route typically looks somewhat like this. Where you get the biomass, you do some sizing and pre-processing. But then you have got to get the sugars out and the sugars reside in the long chains of cellulose and hemicellulose. So you have got to do some kind of a hydrolysis.

There's lots of hydrolysis processes out there that can be used. There's strong and weak acid hydrolysis processes, there's enzymatic ones, steam explosion, ammonia explosion, quite a few

different approaches can be used. And it is not my purpose here to pick one today because it would depend on the industry and the situation, the feedstock, as to which one is going to work in that situation.

But once you have done the hydrolysis to get the sugars from the biomass, then you want to ferment those. Then unlike a corn situation where you are using cellulosic biomass you have not only the six carbon glucose-based sugars, the -- anyway, you have five carbon sugars as well as the Xylose, the cellulose-based six carbon sugars and the Xylose-based five carbon sugars. You have got to be able to ferment both of those to get a decent fuel yield.

And the organisms that do those fermentations are less well-developed than the organisms that just do six carbon sugars. They have got some additional things there. In product recovery you have got a dilute stream of ethanol or other, or other products. And that is going to be more -- the sugars coming out of your cellulosic biomass process are more dilute than the sugars from a corn-based biorefinery and that's one of them.

So the ethanol is going to be more dilute from a cellulosic biorefinery. So hence you are going to have to do a little extra work in the product recovery as well. The whole thing depends on what it says down there at the bottom. You have to do good hydrolysis and good fermentation of the five and six carbon sugars to have some opportunity for economic success.

So what's happened? Well, people have been doing research on lignocellulosic biomass, particularly ethanol, for about 30 years. I have been involved with the biomass program through the Department of Energy for a good part of that. And a lot of work has been done and a lot of progress has ben made. Better hydrolysis, better fermentation organisms, reduced enzyme costs. All those have been achieved in various, in various ways.

And the RD&E is still continuing at the federal level in a lot of ways. Certainly -- I think you are all familiar with the big bioenergy centers doing basic research. And one of those is located, of course in California. The Department of Energy continues to fund research on enzyme improvements, on ethanologen improvements and

others. And as a result of all that research that has gone on the projected prices for producing ethanol, at least from cellulosic biomass, has tracked down as well.

Now this is some, this is a graph from the Department of Energy which shows some modeled costs, just modeling done by the National Renewable Energy Lab. And of course any set of analyses depends on the assumptions that these are for an nth (phonetic) plant. And nobody has made the first one yet, let alone the nth one. And they are based on laboratory results being able to be achieved at those nth plants.

So there's certainly some uncertainty in these numbers. But the trend here is what's important more than the absolute numbers. So please don't beat me up at the absolute numbers. The trend is though that the projected costs of producing ethanol from lignocellulosic biomass has gone down over the last several years. It's gone down quite dramatically and it is getting to the range now where it is looking more and more interesting on a commercial basis.

And as a result of that commercial interest several large-scale demos have been

started by industry. Part of that was through the EPAct legislation for the 932 demonstration scale, the large demonstration scale facilities. Part of the additional work which Congress requested the Department of Energy fund on a ten percent scale. And there's solicitation plans (indiscernible) on a smaller scale advanced biofuels. The Department of Energy has that out now. If after this phone call people want information on that look at grants.gov or give me a call or an e-mail and I'll help you find that.

Just a quick summary of some of those things that have happened in those large-scale solicitations. The large, commercial scale 932s. One of those, BlueFire in California, looking at using biomass collected from municipal waste systems. This is highly sorted waste. But the biomass sorted from municipal waste into ethanol. They have a demonstration plant there in California. Three of the four here are biological-based processes; one is a gasification.

Similarly, the so-called ten percent scale facilities were slightly more advanced ideas. I believe there's nine here and I believe seven of those nine are biological-based.

So the take-home message here is simply that biological conversion systems are nearing commercial production. Right now there is no ethanol produced commercially from them. However, they are at the point where they are nearing commercial production or nearing the point where they can get to commercial production.

I have been talking largely about ethanol and I want to mention some other things in passing here because they could be important. One, you don't have to make ethanol if you are doing biological conversion. There's other processes that you can do.

You can use the same source of hydrolysis, processes to get sugars and then use different organisms to make biobutanol. Biobutanol has different characteristics. It is more energy dense and in many ways might make better transportation fuel. Unfortunately right now it isn't authorized for motor fuel use that I could find.

And there's other things besides ethanol or butanol you can conceivably make. You can conceivably make hydrocarbons using biological conversion processes and various things. So if I

missed your particular favorite process I'm sorry. It is no my intention to leave it out. But in a short ten minutes or so you can't include each and every thing that might be interesting.

There's mixed processes where you use a combination of thermal and biological processes. For instance you can gasify biomass and then use fermentative processes to convert this into syngas, CO and hydrogen to ethanol or perhaps other products.

And whether we call algae a biological conversion process or whether we call it merely a feedstock growth process, of course algae is one of those things that has quite a bit of potential at least to make lots of biomass or lots of biofuels. You can make lots of biomass and convert it to something else or you can make lipid oils as part of your algae growth.

In that case, in either case the process of the algae technology development would be around how do you grow this stuff so you have got either the algae or the oil from the algae. You really don't have to do very much. The focus would be on using biology to make it more than it is on conversion.

And of course, like I said, there may be other processes that I missed today. But in ten minutes you don't have time to think of everything.

As we look at California. I'm sitting here in Washington looking at California. I just want to iterate a couple of things. Number one, like I said at first, you are going to have a lot of different feedstocks. You don't have one big pile of just one feedstock like you might have in the Midwest where you have one big pile of corn stover.

You are going to have to have technologies to deal with the variability of the feedstock you might have. Not only lots of little piles but they are going to vary by season, by location and a lot of other things. So your technologies have to face that.

As a result you are going to have things, for instance, a strong acid hydrolysis like BlueFire uses is very appropriate for the kind of feedstocks they are using. They have a highly variable feedstock. The problem with that is they probably have to put up with a little more yields than might theoretically be possible

because the enzymatic hydrolysis gives you higher fuel for sugars but is less robust if you have a variety of feedstocks coming in on a day-in and day-out basis. Something to think about.

Secondly, if I look at the goals that were set out in the paper, you have to think in addition to ethanol you might well be wanting other fuels as well. If you are thinking about only ethanol you are limited at this point in time by national laws to either a maximum of E10 or E85. E20 is not an allowable fuel at this point in time because it doesn't meet EPA requirements.

Hence before very long you could rapidly get to the point where you are producing enough ethanol that you reach the ten percent maximum for all the fuel in California. You can't put any more in because after E85 you might or might not have the vehicles to accommodate that. So there's a sort of ten percent blend wall where you get too much ethanol. You can't have more. So you have got to be careful about that.

And even if you reach the ten percent or more, and even if the laws change, there's distribution, infrastructure, pump fuel requirements, fuel vehicle requirements, that will

require differences from what we have now. Things to think about. So thinking about infrastructure-compatible fuels is probably useful, particularly for California and the feedstocks you have.

One last slide here. So these would be Don Stevens's suggestions for California going forward. Number one: Make absolutely, positively certain that your resource situation is clearly understood. They did the exercise here in Washington a few, a couple of years ago. And from the 70,000 foot level it looked like there's a lot of biomass. The closer to the biomass you get the more elusive it seems. Because things that seemed to be there may not genuinely be available.

In our case wheat straw. A lot of it has to be plowed back into the ground to maintain the soil moisture, the soil moisture and the soil carbon contents in the very dry areas that we have around here.

The second problem is they may be available but at a cost you can't afford. So understand your resource base really well.

If California had additional funding, if you want to do things fast, you have got to put steel in the ground fast, we'll facilitate that

through legislative effort that will help that.

And if you have some money for RD&D there's quite a few things that might conceivably be done. Leveraging the DOE programs is useful I think because nobody has enough money to do everything themselves.

Utilize the expertise at the universities. And that's particularly useful in positioning yourself for 2050, or 2020 and 2050, down the road a few years. By identifying and advancing the next generation of biofuels you lay the groundwork for being able to do that effectively a year or so from now.

Algae might be part of that.

But the last bullet is really critical. Understand and do this within the land and water use sustainability context. It is easy to think about large volumes of biomass. It is harder to think about how to grow it sustainably and don't lose sight of that.

With that I can take any questions for my portion.

DR. TIANGCO: Thanks, Don. Thanks for that short yet comprehensive -- and also for providing some suggestions for California.

Any questions from the Commissioners?

PRESIDING MEMBER BOYD: No questions.

ASSOCIATE MEMBER DOUGLAS: No questions.

DR. TIANGCO: Okay, our next speaker will also be doing this on-line and it will be John Scahill. He will be sharing the presentation on the thermochemical conversion pathway.

MR. SCAHILL: Okay. Can you hear me, Val?

DR. TIANGCO: Yes John.

MR. SCAHILL: Okay. We are at the end of my presentation. Do I have control?

DR. TIANGCO: Our webmaster is doing it right now. You have control now, you can go back to the beginning.

MR. SCAHILL: It's not, it's not moving on my screen.

DR. TIANGCO: Okay. We had this problem this morning we we'll try to --

MR. SCAHILL: Okay. Okay, now I have movement. All right, now we are back to the front. Okay. The other thing I was going to ask, is my pointer showing up on your screen, the cursor pointer?

DR. TIANGCO: Okay.

MR. SCAHILL: Okay, I think that lost control. What I'm showing now is my --

MR. NGUYEN: Click on the slide and then you should be able to move with the up and down arrows.

MR. SCAHILL: Okay, I don't see it, I don't see it moving. I don't see the up and down arrows on my screen.

MR. NGUYEN: No, it's on the keyboard.

MR. SCAHILL: Okay, even on my keyboard. Oh there I go. Now it's working. Okay, I'll go ahead and get started in the interest of time.

As Val pointed out my name is John Scahill and I am with the Office of Biomass Programs within the Department of Energy in the Office of Energy Efficiency and Renewable Energy. And I am going to talk to you about the other approach to converting biomass into fuels and that is using heat or thermochemical conversion.

Okay. Our program is actually driven by a lot of different taskmasters. And this is a busy slide but the only purpose of it is to show you where we get our direction from. And that comes from the Executive branch; edicts coming from the President. Also from Congress through

different energy policy acts. And also internally within DOE we have our own internal direction. All of those things funnel down into what is characterized as our Office of Biomass Program vision or mission or performance goals.

And today that primarily means converting biomass into liquid transportation fuels. And this is a chart from the recently passed Energy Independence Security Act. And what our direction is, basically from that previous slide, is to fill in the blue, green and red components of these bar graphs.

And as Don pointed out in his presentation, corn ethanol is taking up all of the volume in the bottom that's in yellow.

So how do we do that? The approach is looking at a biorefinery concept. And Don showed the same slide only in a different format. But basically we feed biomass into this refinery in two primary platforms or approaches. One is the breaking down of the sub-states with enzymes and acids. And what I am going to talk to you about is this thermochemical approach using heat to break down that sub-state.

And if we look at the substrate.

Biomass contains lignin, hemicellulose and cellulose. The cellulose and hemicellulose components of this biomass are what Don just mentioned to you. And you can see from a chemist's kind of interpretation of what biomass looks like, it's primarily made up of hydrogen, carbon and oxygen. You can see those elements making up most of the material you see on the screen here.

So our task is to break that solid material down into smaller components. Basically go from a solid to a liquid or a gas and then take those intermediates on to the final fuel product.

So the way we do that in the thermochemical platform is we apply heat and potentially a residence time to the material. And this thermoconversion pathway always essentially starts with pyrolysis. As we look to the right and the temperature is driven up in the residence time it is also increased -- pyrolysis is the first thing that occurs. And I am going to talk about that in a few minutes.

But as that process continues basically what happens is the, the initial fragments that break down from that substrate are essentially

exposed to higher temperature and longer residence time. That material then breaks down into what you see here as carbon monoxide, hydrogen and small amounts of methane.

There are also contaminants that go along for the ride and those are things like tars, also smaller amounts of sulfur compounds that may be present in different feedstocks. So the real focus from an R&D standpoint in the thermochemical platform is in this gas clean-up and conditioning step. Basically the removal of those contaminants. So I am going to talk about that initially in the gasification and then I am going to go back to the pyrolysis component.

Biomass gasification has a relatively long history. There's a lot of work that has been done over the years, both in the United States and internationally, mostly in Europe. And these are just examples of some of the recent, more recent gasification projects that have been underway. But as you can see here, most of these are in the 50 to almost 200 tons per day through-put capacity. So these types of systems don't generally lend themselves to certainly remove areas. And particularly in the Western United

States and parts of California where you have a lot of federal, federal land.

Back to the clean-up issue. There are cost-effective clean-up technologies that are currently in use. These are primarily applied in large coal gasification plants where they use technologies called Rectisol or Selexol. These, like I said, do work at the larger scales but the biomass plants don't lend themselves to that economies of scale. A typical coal gasification plant can consume upwards of 30,000 tons per day, where we will be very lucky to get biomass plant capacities up to the 3,000 tons per day. So it's kind of a order of magnitude smaller.

So what the office of Biomass Program is doing is looking at technology development that will be just as effective as the Rectisol or Selexol but at a much smaller scale. And in 2004 and 2007 we put out solicitations specifically directed towards this gas clean-up issue. And there's also ongoing work at the National Lab directed towards this issue as well.

And again another busy slide. But the only important take-away message from this slide, if you look on the left hand column there are a

number of different types of products. Fischer-Tropsch synthesis can make gasoline or diesel-type hydrocarbons. And then of course methanol synthesis has been around for decades, commercially produced syngas made from natural gas. But the point of this slide is if you look at the level of contaminants that the catalysts use for converting that synthesis gas these levels are extremely low. They are in the parts per billion or very low parts per million range. And that's what presents the huge challenge.

This is an example of work that is ongoing at the National Renewable Energy Lab and other places, other parts of the world. But nickel-type catalysts have been show to be very effective in eliminating or reforming these compounds that you see on the stream here, benzene, toluene, phenol.

The problem is that after a period of time the catalyst becomes fouled or poisoned and the activity then starts to decline. The goal there is to figure out how to make more robust catalysts and/or develop processes that will be able to regenerate these catalysts.

Another project funded by DOE is with

the Gas Technology Institute in looking at engineered catalysts. Things like nickel-impregnated-olivine. These have also been shown to be very effective in destructing or reforming. In this case naphthalene is a monocompound that is meant to simulate the tars. But we can essentially get rid of 100 percent of it under the right conditions.

Another exciting catalyst development is in the glass ceramic materials also containing nickel oxide. These are essentially materials similar to your Corningware glass. They get creative in how they incorporate metal within the matrix of the glass.

And this is another example of nickel-magnesium-silicate-impregnated ceramic catalysts. And the key thing here is that it shows the ability to also reform that methane. And that is an important consideration in improving the overall conversion efficiency. That methane cannot be catalytically converted to alcohols or other fuels through the catalytic process so we need to either get rid of it or the best thing is to reform it into additional carbon monoxide and hydrogen.

This also looked at also spiking the gas stream with low levels of hydrogen sulfide as a poisoning agent just to see what would happen with the catalyst. And it seems to hold up fairly well against this.

Another thing that we have done in trying to advance this clean-up area. Last year, actually in late 2007 we ran a solicitation looking at requesting proposals for people to do clean-up and validation. And these are essentially integrated projects where they take syngas that is generated from actual biomass and gasifier and do the clean-up and validate that they can indeed achieve those very low parts per million or parts per billion levels. We had a total of five projects that were selected and these are now just getting underway.

Okay, now I am going to move into the area of pyrolysis. Which if you recall in that earlier slide I showed you that this is the first stage of thermochemical processing.

And basically what we want to do here is expose the biomass to very high heat fluxes and very short resident time. When we do this we can generate as much as 71 percent of that biomass can

be converted into that liquid that you see on the right hand side of the column. The other products that are made are gases that have a relatively high heating value. And those gases can be used to drive the process itself. And char is the other co-product that is made.

The exciting thing about this technology is that these bio-oils can be looked at as essentially a refinery feedstock. And what you see on this slide are two existing petroleum refinery, what we call unit operations, hydrotreating and hydrocracking.

And these operations basically reject that oxygen that I pointed out to you earlier in that slide that had the molecular structure of biomass. All of that oxygen that was present there needs to be removed. And that same oxygen is also present in the bio-oil.

So with these two processes we essentially inject hydrogen and the hydrogen then displaces the oxygen on those molecules. And it is rejected in the form of CO2 and water. So the products then resulting from this are basically hydrocarbons, that oil into gasoline, diesel point range. And the real advantage here is that we can

leverage the existing investments that have been made in petroleum refineries.

This is an example of what those products look like. On the left hand side the paraffin, iso-paraffin. These are nomenclature for types of hydrocarbons that are typically present in gasoline and diesel. And the gasoline components, these are the ranges that we see from this hydrotreating, hydrocracking process. And they are compared against what we see in a typical gasoline in today's marketplace.

The other exciting thing about this. The numbers that are presented here actually came from a cooperative research and development agreement that DOE has allowed two of the National Labs to enter into with a major technology provider to the petroleum industry.

So they took the yield data resulting from some of that work and put it into their economic model. And these are the way the numbers were spit out. So the production costs of these hydrocarbons is roughly around between $2.50 and close to $2.80 a gallon. And while today these may not look that favorable, but you compare these against what people were paying just this past

summer, these are close to being in the ballpark of being economically competitive.

So the technology kind of hurdle or one of the things that we need to get around is instability of these oils. And this instability is caused essentially by chemical reactions between some of the compounds that are present in the oil. And these reactions essentially increase the viscosity, case phase separation, formation of gums and deposits and stuff.

Research in the past has shown that these are tied to the acidity of the oil. The acidity comes from acetic and formic acids that are produced as part of that pyrolysis process. It is also tied to the char fines that sometimes get carried over into the condensed oil. And also the amount of oxygen that is originally in the bio-oil itself. And just this past year our office released another solicitation requesting proposals directed at these particular issues.

This is a chart that I wanted to expose people to, to introduce them to this concept called Terra Preta. And this is something recently observed in parts of the Amazon where ancient Amazonian Indians had buried charcoal in

the soil. And the result was it dramatically improved the productivity of the soil. There's been some research in the last ten years looking at this phenomenon and they think that this is tied to the fact that the presence of carbon improves the essentially soil nutrients, the water retention and the microbial and fungus habitat, which are important for healthy soil.

So this may offer a potential for significant carbon sequestration as a result. Even though there have been some early positive effects in this; some of the studies have been inconclusive. We don't know if this works, you know, well in acid and basic soils or in different latitudes so there still needs to be some work done. But nonetheless it is a promising potential, particularly in light of the ability to also produce liquid fuels from biomass.

Don mentioned some of these in his talk so I am not going to go into these in any great detail. I'll just point out that there are commercial scale biorefineries that are currently in the process of being put in the ground.

The picture you see here is actually of the Range Fuels site in Soperton, Georgia. They

have started construction on this and some of the large pieces of the processing equipment have been ordered. They expect to start commissioning of this plant in early 2010. So about a year from now. However, the collapse of the financial markets are probably going to slow the progress of these projects as a result of the inability to get adequate capital to keep building them out.

The other thing that I was going to talk about a little bit. This was one of the questions that people asked the presenters to look into and that was the use of water in fuel production. These numbers have come from a recent paper published by Argonne National Lab. And it shows, and I put these all on the same graph as a comparison to look at the water usage of gallons of water per gallon of ethanol.

And this is corn ethanol and it is compared to lignocellulosic bioconversion, lignocellulosic thermoconversion, lignocellulosic hybrid. This is the one Don alluded to earlier which is fermenting syngas into ethanol. And it is also compared to producing gasoline from petroleum.

So my last slide, just some conclusions.

Biomass actually is the only renewable that offers the opportunity to displace petroleum-based liquid transportation fuels.

Some of these technologies look commercially viable within the next five to ten years.

CO2 sequestration or CO2 neutral is one of the key attributes of biomass into liquid fuel.

And the other aspect of producing domestic jobs in rural economies is another plus to this technology.

So with that I will take questions.

DR. TIANGCO: Thanks John. Any questions from our Commissioners?

PRESIDING MEMBER BOYD: I have one quick question. John, this is Jim Boyd, thanks.

Your reference to Selexol and Rectisol only for coal gasification stimulated my ancient memory. I thought that I had seen that in Sweden they use this technology and they use these approaches for their processing of biomass to energy. Do you have any information on that?

MR. SCAHILL: It is indeed quite possible to do that. The problem is that it is more expensive so it adds more cost to the bottom

line. Now in Sweden they are currently paying about $8 or $9 a gallon for their regular transportation fuel.

PRESIDING MEMBER BOYD: And I think this is strictly for conversion to biogas as well.

MR. SCAHILL: Okay. Well, in the biogas are you referring to synthesis gas?

PRESIDING MEMBER BOYD: No, actually biomethane eventually.

MR. SCAHILL: Well that's a different process. That's anaerobic digestion. And it does make mostly methane but there are some sulfur and other contaminants that are also present there. But I think that they can use conventional scrubbing, water scrubbing to remove those from the anaerobic digestion, biogas component.

But if you are doing gasification. And the Swedes have indeed been doing gasification for quite a long time. As a matter of fact some of the early nickel-based catalysis work came out of not Sweden but Finland. So, you know, folks from the Scandinavian countries have large, biomass resources. They have been looking at this for quite some time.

But if it is the syngas clean-up and the

tars and other sulfur-containing compounds, they could indeed be using the Selexol. They will be paying, like I said, a higher cost for doing that at that scale.

PRESIDING MEMBER BOYD: Okay. I have a suspicion they do as they clean up the first or second stages of biogas to biomethane in order to get it to be a fairly high percentage of biomethane and to treat all the other ingredients. I could be wrong but I will have to look it up again. But of course Sweden is very deficient in terms of any form of natural gas so they are probably willing to pay the price.

MR. SCAHILL: Yes, correct.

PRESIDING MEMBER BOYD: That's all.

ASSOCIATE MEMBER DOUGLAS: No questions.

DR. TIANGCO: Okay, thank you, John, for that great presentation and great overview on where we are on the thermochemical conversion pathway for biofuel production from biomass. I remember Ray Cutchen, whom we called guru of lignocellulosic biomass to ethanol, always said, biomass to ethanol, or lignocellulosic biomass to ethanol has always been a bridesmaid, never been a bride. So with these things that are going on

through DOE and through other forefront including private funding maybe next year we'll see the first thermochemical oven and also biochemical conversion pathway of biomass to biofuel.

Our next presenter is Dr. Bryan Jenkins who will be sharing the UC Davis-Chevron Biofuels research. Bryan.

DR. B. JENKINS: Thanks Val. Commissioners, a pleasure to be here. I am going to share a little bit about the UC Davis-Chevron Joint Research Agreement in biofuels, mostly from the UC Davis side. I won't actually be able to give you a whole lot of detail about the Chevron side because, well, we have a certain agreement with Chevron. There wasn't quite time in the two days I had to prepare this since I was asked to do this to get a review of it done. So I'll give you a little bit of information about it. If you want more information there's some contact information at the end. But I'll give you the basic perspective on this.

So this is a program which is administered through the new UC Davis Energy Institute. And I'll tell you a little bit about this because it is perhaps important in some of

the way we administer this program and try to cooperate with various others outside the university in the program.

But I have had the pleasure of serving as the director of this Energy Institute since the fall of 2007. I was supposed to be interim, we had a director search underway, but it was suspended two months ago, a month and a half ago actually, because of the financial crisis of the university. So I am with it right now. You'll see me around for a little bit more I guess.

Anyway, this Institute provides coordination across the campus for both research and education on energy. We have a post-graduate group, for example, that grant MS and PhD degrees in Energy Science and Technology and Energy Policy and Management. So we have been working on that.

But the Chevron program serves as part of this and the Institute also administers a number of other centers and programs, including the Energy Efficiency Center which you probably heard a lot about recently. In fact I just earlier at noon, actually 11 o'clock, was up at the Sutter Club up the street where the announcement was made for an endowed chair in the

Efficiency Center from Chevron actually for the director of that Center. So there is quite a bit going on in the way of public/private partnerships in these various energy areas. So anyway, that's what the Institute is doing.

In terms of the Chevron program. In 2006 the University wrote an agreement with Chevron to conduct research in the biofuels area. The agreement itself is actually on-line if you wish to inspect the agreement and the terms of the agreement. There are a few numbers that have been redacted in the public version, I am not quite sure why, but anyway, the terms of the agreement are public and you can inspect those on the website which I will show you in a bit for the Energy Institute. Basically if you go to energy.ucdavis.edu you'll find a link to that agreement.

Basically what it did was set out an agreement between Chevron Technology Ventures and the University to conduct a program in biofuels research over a five year period with a total of $25 million. And we are in the third year of the program at present. We have 41 funded projects through three solicitations, three annual

solicitations. Or about $15 million invested to date or incurred to date in the research area with another million or so in equipment grants that have gone to support the research across the University in what you might call a distributed laboratory, a biofuels laboratory at the University for this type of research.

I can't give you the details on the projects themselves because of this agreement that we have but I can give you a little bit about the nature of the research. It is really intended to address the issue of scale and magnitude when it comes to biofuels.

Scale. Of course Chevron as a petroleum refining, mostly petroleum refining company is used to very large scales. They need to supply us with the fuel that we demand, or some part of that in their case. So they are used to facilities that operate at say in the 100,000 barrels per day capacity range.

We know that biomass as a solar resource is a distributed resource. And to try to amass the amount of biomass into centralized facilities that would support that kind of development is a fairly horrendous undertaking as far as logistical

support and it is fairly expensive. So we are not likely to operate at those scales although we may get there eventually.

So we are looking at ways in which we can address the difference in scale between what Chevron as an oil company might be used to versus what the biomass industry might be able to develop and what research might be able to support in the way of scale for biomass facilities. You know, the type we have just seen in the last few presentations as well as some other types of facilities that might develop over time.

And of course integrated facilities that produce not only biofuels but also fuels or energy, electricity, heat. That are integrated in the way we saw in some of the slides but also bioproducts, various high-value bioproducts. And also the bioplant. So this is all of interest and concern in this research program.

There are various modeling aspects in addition to direct laboratory or experimental work as part of this program. Some of the modeling went to support some of the efforts that I think Steve Kaffka talked about in his presentation. Unfortunately I couldn't hear that so there are

also modeling efforts underway with this.

This is really leveraged off a lot of the work that has existed at UC Davis and continues at UC Davis. Funded not only by Chevron but by many others as well, including the California Energy Commission, the Department of Energy and USDA, EPA, the National Science Foundation and many others.

So we have sort of a long history in research in biomass and many different areas. Chemical research, that's my own research field for the most part. Biochemical and biofuels production and processing with biodiesels as well as other hydrocarbons and vegetable oils. Bioproducts of various types.

Logistics, optimization of the biomass systems. Environmental and social impacts, lifecycle assessment. And this is all very much interdisciplinary across campus. There are people sitting in this room who have not had a chance to speak today who also participate in this activity.

As part of the answer we have an Energy Initiative across campus which has also resulted in building capacity of the sort which I heard mentioned this morning in some of the talks about

how do we build the support we are going to need out to 2050. And a lot of that has to do with the students that we train now, the other training that we do and the faculty that are hired now. So we have been in the process of hiring 15 faculty in the energy area. We have seven faculty hired at present and another eight searches underway while this was going on.

Also of course the Collaborative as administered through UC Davis. Steve Kaffka serves as the director and you heard him speak earlier. I think you even saw this slide before. So a lot of this is leveraged off the collaborative work.

And also we have other programs through, for example, the Institute of Transportation Studies, John Muir Institute of the Environment, the California Institute of Food and Agricultural Research. I know Sharon Shoemaker is here in the audience. And there are many other programs across campus that support this kind of effort.

So I am going to leave it at that to indicate that we have, we are administering the Chevron agreement for biofuels, looking at the scale issues as well as a number of other basis

research issues.

And if you look at this list of committees that we have, that exist within the Bioenergy Research Group, which also was started just prior to writing the Chevron agreement. These are largely the areas that are addressed by not only the research across campus but also from the Chevron agreement and other agreements that we have.

As you can see they range from the very basic level in molecular and cellular chemistry and biology, genetics, genomics and the like all the way through to the engineering, conversion systems, production systems as well as the resource management issues, environmental quality and the production of the biomass itself.

So if you want some more information about this I am happy to provide what information I can. Otherwise you can contact me, the information is here. Or you can also talk to the Executive Director of the Institute, Billy Sanders. Carol Kruger is our coordinator for the Chevron program. She is happy to supply any basic information about the program but she won't be able to give you a whole lot more information than

what I have given you here today.

So anyway that is where we stand on that. Any questions? I'm not sure that with the information I gave you you would be able to ask any questions.

PRESIDING MEMBER BOYD: I don't really have a question, Bryan. I'm going to pick on you because we're good friends. But both the $500 million grant to UC Berkeley and this grant to UC Davis. I don't want to say they give me heartburn but the fact that we can't talk enough about it. I appreciate if they weren't spending that money the research wouldn't be going on. It's just it's tough to not be able to know more about it sometimes, as we try to decide how to invest public monies like through our 118 program. As we try to get a reading today as to where are we in this whole arena. But that's just a philosophical comment.

DR. B. JENKINS: Well I'll comment on your philosophical comment.

PRESIDING MEMBER BOYD: Okay.

DR. B. JENKINS: Because your comment, you are not alone in this opinion. There are others who share some interest in being apprised

of that information in greater detail. I think this will come eventually. I think we are trying to find our way under a lot of these public/ private partnerships.

And of course there was a lot of concern, contention about the EBI grant and concern about the Chevron grant. I think we need to find some way through this process so that we can be working in these public private partnerships effectively and I think we'll get there. I don't think -- It's like these minor details of not being able to say something specific about this. We need to work through this somehow.

PRESIDING MEMBER BOYD: I'm a big proponent of public/private partnerships, having been through this experience for the first time in my years at the Air Board, which turned out to be a very satisfying experience. But they were 100 percent in the sunlight and everything was discussed in, you know, kind of public forums, et cetera, et cetera. In any event, hopefully you'll wrestle your way through that.

DR. B. JENKINS: I'll also comment that the issue of transparency was important to us when

we wrote the agreement. Now I didn't sign the agreement but I wound up somehow in a position where I am going to try to provide coordination across campus for this agreement.

There is, in fact, no specific limitation on publication so the results of all these activities will be forthcoming. It's just that there is a review part of the agreement, which there is an inspection for intellectual property. Chevron wants to make sure, of course, that it gets the benefit of the business development opportunities coming out of the research that they are funding. Whether you agree with this approach or not I'll leave to you. But the publications will be coming eventually. There is no essential limitation on that in the agreement.

PRESIDING MEMBER BOYD: Thanks.

DR. B. JENKINS: Thank you.

DR. TIANGCO: Thanks Bryan.

As a response to the Energy Independence and Security Act of 2007 the Office of Bioenergy Science -- Basic Energy Sciences, Department of Energy, called for two centers. Three centers were funded and we are fortunate enough we got one

of the centers located here in-state. Dr. Harvey Blanch will be sharing the Joint BioEnergy Institute and some of the things that are going on at the moment. Harvey.

DR. BLANCH: Thanks very much for the opportunity to tell you a little bit about the research activities at the Joint BioEnergy Institute. It is one of the three BioEnergy Centers that was supported by Department of Energy the Basic Energy Sciences Division.

Originally the call was for two proposals in here and three were funded. The funding for each center was initially 125 and later became 134 million over five years. So roughly -- Initially it was 25 million per year for five years.

The JBEI institute that we put together is actually a consortium of three national laboratories, two universities and the Carnegie Institute. The lead laboratory is Lawrence Berkeley National Lab. Sandia National Lab represents the second largest component of the consortium in terms of staffing. Lawrence Livermore, UC Berkeley, UC Davis and the Carnegie Institute.

So we are located in Emeryville. All of the staff works in one location in Emeryville. We have currently about 125 researchers. That should grow to about 150 by mid-year this year. And everyone is working together so we avoid many of the issues that typically we find on campus with programs that are in various locations. So everyone comes to JBEI and interacts strongly. We believe that is very important in this kind of research program.

We have adopted a start-up company approach which is rather unusual also for a national lab and university consortium. The idea being we want to be very nimble, able to change direction and reallocate resources very efficiently as a result of changing the research directions and programs.

We have four science divisions: Feedstocks related to plant biology; deconstruction, which is the decomposition of the biomass into its constituents; fuel synthesis, which is the conversion of sugars into fuels. And this is supported by a cross-cutting technologies division.

We also have an industry partnership

program where we interface with industry. They contribute to part of the research programs. The idea is to provide a route for us to better understand the issues involved in biofuels production and for them to get a very close look at the technology we are developing. So this addresses one of the needs that DOE had, which was to translate technology rapidly into industry.

The previous speakers have very nicely mentioned the problems in converting lignocellulosic biomass into fuels. And I will just very briefly share our perspective on this with you. Ultimately what we are looking at is developing bioenergy crops where the cell wall material serves a the constituent for conversion into a fuel. These may be crops such as miscanthus, switchgrass, maybe things like municipal solid wastes.

These are broken down into their constituents, the cellulosic and hemicellulosic components which are sugar containing, and the lignin, which is sort of the glue that holds the biomass together and prevents pathogen and insect attack. It presents an opportunity for production of a byproduct.

These are broken down into constituent monomers. A number of routes for doing this have been presented earlier, either acids, bases or enzymatically. We are focused on an enzymatic route because any of the other processes involve a loss of the raw materials in converting the lignocellulose into a sugar. The sugar components are then converted microbially into fuels.

I just put ethanol there but in fact we are not working on production of ethanol at all. That's rather a well-understood process. We are looking at production of non-ethanol fuels.

So let me just go over the technology challenges that we see. In the feedstocks area we are looking at developing specific bioenergy crops. One of the difficulties in breaking down plant material is the hemicellulose and cellulose are occluded by lignin. It sort of acts as the glue holding the whole thing together. And that is very difficult to break this apart. So we are trying to develop crops where we can have lignin which is much more readily broken apart.

These would be genetically modified crops. Specific crops for bioenergy that are much easier to deconstruct. As a result we also want

to understand how the cell wall in plants is synthesized, with the objective of making more cellulose and getting higher yields.

The hemicellulose component is attached to the lignin through linkages which when broken down make inhibitors that carry through the rest of the process and reduce the overall yields and the formation of product, so we want to reduce those.

The second area is in the breaking down of the lignocellulosic material. And the challenges here are related to the fact that the lignin is a difficult challenge to solubilize in a sense and break down the crystalline amorphous regions of cellulose and hemicellulose.

Many of the pretreatment methods form these inhibitory byproducts. So that's the focus there. We are doing this enzymatically because, as I mentioned, acids or bases result in a loss of the raw material and this is a commodity product where the raw material costs dominate. So it is very important that we retain all the raw material.

Finally converting the sugar to fuel. We are talking the position that the conversion of

sugar to ethanol is rather well-understood. The yields are around about 95 percent of theoretical. There is not much upside there. The upside is for us looking at other fuels. These may be things such as butanol. But we are really focused on making fuels which are directly mixable with gasoline. So these are more fuels such as octane and C12, C14, C15. Hydrocarbons that can be directly blended with gasoline.

This gets around some of the problems. Here we have the challenges. That not all of the organisms that we use are able to use all of the sugar components. We need to be able to develop the organisms to do that and to get around these problems of inhibition.

So our approach is to have these three divisions focused in each of these areas and supporting technologies group.

I just want to sort of reiterate the importance of raw material costs because we have heard a lot of potential raw materials being discussed this morning. And these are only viable depending on their costs.

So I'll illustrate why we are interested in lignocellulosic materials. If you look at the

left hand side here you will see a Biomass Source. Miscanthus, which is a grass. Switchgrass would be similar with yields of say up to 25 tons per acre. And the cost of the sugar that we would get from lignocellulosic-based biomass is around five cents a pound.

Poplar woods that would be grown as energy crops yield prices of sugar, glucose equivalence, a little bit higher but still much lower than corn, which has fluctuated as we know quite wildly recently, but has been as much as 30 cents a pound. So in this range of 20 to 30 cents a pound.

Sugar cane, sucrose. The world price is about 11 cents a pound for the raw material, the US price is about double that.

If we then look at converting this into a fuel products. These are minimum theoretical amounts in the middle column of how many pounds of the glucose material we need to make one gallon of fuel. You can see we need nearly 13 pounds of glucose to make a gallon of ethanol. Which translates at 25 cents a pound for glucose to a raw material cost only of a little over $3 a gallon. Comparable numbers for butanol and octane

and so on.

In the chemical business a rough rule of thumb might be, if we double the raw material cost that will be approximately the selling price of your finished product. So we look at doubling these numbers to get an effective cost of any of these alternative fuels based on 25 cent a pound glucose produced from corn.

The objective then is to look at miscanthus, from which we might be able to produce sugar for about five cents a pound, a factor of five less, and therefore a very attractive raw material for production of fuels.

So our objectives are, in short, to develop fuels that are miscible with the existing gasoline infrastructure. And these are going to be of common numbers of 8 to 15 roughly but could also be used for jet fuels and diesel.

They will have a higher energy content than ethanol.

And they won't require changes to the existing automobiles.

We want to develop feedstocks that are specific bioenergy crops that could be planted in marginal lands. And these crops are not starch-

based and don't compete with the feed or food applications.

To date we have developed fermentations to produce these fuels. We are currently optimizing them. These are C12 to C15 alkanes. They have the advantage that they are not miscible with water. They freely separate in the fermentation and so we don't need the expensive energy-requiring distillation, as is the case with ethanol. They simply freely separate into two, a water and a fuel phase.

We have developed approaches using new solvents to solubilize biomass directly and produce sugars in high yields.

And the crops are being developed as bioenergy crops. This is a much longer term proposal, probably five to ten years at a minimum, for developing any new bioenergy crops using current genetic tools.

We were asked to provide just a few recommendations. One would be that certainly cellulosic-based biofuels are going to have lower raw material costs and will not compete with the food/feed crops otherwise.

There seem to be considerable amounts

available, on agricultural residues particularly, that can provide this kind of biomass in the short run.

Later on bioenergy crops can be grown on marginal lands.

And there is a potential use of municipal solid waste-type materials and wood residues that could be converted with these kinds of technologies.

So it is my hope that standards will not be written using ethanol as the sole biofuel alternative. Other fuels which will be directly miscible certainly we hope will be available. Several companies today are producing them in pilot scale facilities from sugars.

The scale of biofuels use in California I think is going to translate into what kinds of feedstocks we can actually consider.

And the timelines we think might be kind of parallel to those of the current S-06-06. So thank you.

PRESIDING MEMBER BOYD: A quick question. Your references to MSW conversion to biofuels requires further research and the previous slide had a comment about the possibility

of getting cellulose out of MSW.

It is my understanding there is a rather significant amount of green waste that finds its way to landfills, which I may be mistakenly classify as basically cellulose. And an incredible amount, at least in California, of urban wood waste that finds its way. And other than us being able to get our hands on it to use it, what additional further research do you think is needed in that arena?

DR. BLANCH: I think you put your finger on exactly the kind of research. How do you actually classify, separate these materials and find associated costs. Beyond that I think they will serve as excellent feedstocks.

PRESIDING MEMBER BOYD: Thank you.

DR. TIANGCO: Thank you, Harvey. The next presenter is Dr. Susan Jenkins who will present the BP Petroleum-funded research through the Energy Biosciences Institute. Thank you.

DR. S. JENKINS: Actually I think we prefer to say the EBI research funded by BP Petroleum.

I would like to thank you for providing the opportunity to come share the goals, the

research agenda and the progress to date, the potential contributions the Energy Biosciences Institute might be able to make to help the state realize its biofuel goals for 2050.

For those of you who don't know the EBI was formed in 2007, the fall of 2007, as a partnership between UC Berkeley, LBNL and the University of Illinois at Urbana-Champaign and BP as a partner.

BP committed funding of $500 million over ten years. About $35 million a year actually flows directly into the academic research programs at the three partners, the three academic partners, UC Berkeley, UIUC and LBNL.

The goals include total system solutions to the production of biofuels that are cost-effective and sustainable, the development of approved biotechnologies for energy applications, not just biofuels but other bioenergy applications as well, and the education of scientists and engineers across relevant disciplines in this area.

In summary the EBI is an academic research institute that is going to perform basic, fundamental research in the area of bioenergy with

an initial focus on biofuels. And the initial focus on ethanol as well but, as others have said, ethanol might not be the ultimate end product for biofuel.

To determine if the biofuels that we are looking at are environmentally, socially and economically feasible and sustainable.

And I should also mention that BP is a global energy company and so their vision in this is a global solution. So much of the research we do is aimed at that vision but I think it will translate into other levels as well, the state and domestic, the level of the country.

This slide illustrates in general how our research topics are organized within the EBI. We are looking at all aspects of biofuels as are some other institutes. And we are doing so by spending a significant part of our research funding, almost 25 percent in the first year, upwards of $5 million alone, on what we call our ESC Dimensions. It's our environmental, social and economic dimensions.

We are studying many aspects in this area but probably two of the most important are the complete lifecycle assessment of biofuels as

well as the environmental concerns.

In addition we also look, in the blue circle there, at the basic chemistry and molecular biology involved in the process of lignocellulosic biofuel production. Research that mostly takes place in a lab setting as well as agricultural aspects shown in the orange circle there, much of which is fuel-based research.

Most importantly we continue to tie all of this research back to the LCA and the environmental and social studies covered in ESC programs to ensure that we are on the right track as we move forward.

We are, at least until perhaps recently we were unique in that we are one of the few institutes of our size that truly integrates a large number of researchers from a wide array of disciplines to address the field of bioenergy from every angle, as illustrated on this slide. And I think you will have an even better appreciation as I go through some of our projects.

We have 53, I think, currently funded programs and projects in our institute. All of our projects have a two to three page project description on our website. So if you are

interested in learning anything about what the EBI is doing you can go to the EBI website and those are readily accessible.

Again like the Davis-Chevron deal we do have a small time frame, 30 days, of review period if we are going to publish any of the research. But I can say in our case the review periods have been much less than the 30 days and we do have several publications that have been submitted and I believe are patents as well. And as soon as the patent is available we can, that will be publicly available.

The benefits of the institute, obviously besides the $35 million is that as an academic research institute we don't always have the capacity for scale-up. And so what we do in our academic setting is proof of concept. And so we will rely on BP to make, to translate that into commercial applications as we move forward.

Okay our main, four of our main areas that we started in are agronomy and feedstocks, pretreatment and depolymerization, biofuels production, and then as I said, the environmental, social and economic dimensions.

And as you can imagine there's

significant overlap in several of these areas with the research going on at JBEI and the other talks you have already heard this morning so I am not going to go into the details of what the challenges are because those challenges exist in all of those research institutes.

What I will try and highlight are to provide a brief overview of our specific research programs and projects in areas that may prove useful in the future for assessing and implementing the 2050 vision for California biofuels.

I'll start with -- The first area one is, this is one where there's actually very little or no overlap with JBEI but maybe some significant overlap with the programs at UC Davis. In the area of agronomy and feedstocks our studies focus on the development of dedicated energy crops.

At UIUC we have established a 320 acre energy farm that allows us to address feedstock issues in a very controlled way.

In addition to the obtainable biomass studies we also have experts in woody species, salt-tolerant species, pest and pathogen research in the areas listed there.

In genetic diversity investigations we have researchers looking into breeding barriers, which is self-incompatibility in miscanthus. And grass transformation technologies to increase efficiencies.

In addition we have a group that is dedicated to addressing transportation, harvesting and storage. And although the EBI research is focusing mostly on the perennial grass miscanthus as a potential energy crop, the models that we develop in these areas should be applicable to other crops in biomass streams as well.

Okay, now leaving agronomy and feedstocks behind we move into pretreatment and depolymerization. The next three slides I am going to show you will demonstrate our significant, ongoing efforts to address the challenges that, as I said, Harvey already covered in the pretreatment and depolymerization.

So on this slide just to summarize, we are developing tools for visualizing cell walls at a nano level as well as novel tree treatment approaches using ionic liquids, delignification and hemicellulose solubilization and identification of inhibitory products. Again,

already addressed earlier.

Again, pretreatment and depoloymerization from the cellulose angle. We have researchers delving into the obvious areas covering enzyme engineering, discovery of new relevant enzymes from various sources including the popular choices of cow rumen and grass-feeding termites.

And the last slide on pretreatment and depoloymerization. We have more than half a dozen researchers investigating, on the top section there, lignin depoloymerization using biological approaches and chemical approaches to lignin and cellulose depoloymerization as well. And you can read the areas there. And all of these are listed on our website and explained in greater detail.

Okay. Our work in biofuels production currently covers ethanol and to a lesser extent some work on biodiesel. We have very talented researchers in this area between the three institutes and so we are taking advantage of their interest in this area and their willingness to work with us.

Here we are developing -- Well, outside the biodiesel, novel membranes for dehydration of

ethanol.

In the area of biodiesel, assessment study on algal biodiesel production. And I'll mention that this Thursday and Friday we are holding a workshop on campus that is listed on our website that is open for anyone interested in this area. We'll probably have about several dozen experts. And the report from that will be available within several months and again available on our website.

The three other areas under biodiesel: Non-thermal chemical conversion, microbes for bioconversion of biodiesel, chemical conversion of biomass to diesel-compatible fuels.

And then again back into bioconversion of biomass. The bottom there again addressing product toxicity.

So also in biofuels production we have a group taking the systems biology approach to optimize the production as well as additional projects in the other two sections covering sugar utilization in yeast and bacteria. And you have already heard about the five- and six-carbon issue between cellulose and hemicellulose.

So now I'll switch to the environmental,

social and economic dimensions. This is the final area that I'll cover. In the top section there under our environmental research we have greenhouse gas studies for various feed crops. Water issues, which will always be a significant factor when looking at these technologies for producing biofuels. We are studying biodiversity impacts and nitrogen utilization. And again, a lot of this is happening at the energy farm at UIUC.

And as we do this, all of this research. In every aspect it always ties back to the lifecycle assessment area and the work, the models developed. They are refined and tested by our lifecycle assessment team. And they are applying their expertise to biomass production, biofuels production, transport and storage, air emissions and air quality, health and ecosystems impacts and the environmental analysis. In all the areas they collaborate not only within their own group but with all of the other groups researching these areas as well.

We have several programs that collaborate in indirect land use issues including modeling and mapping to define what to plant and

where to plant it. And this is on a US scale as well as a global scale. And we also have very productive work identifying marginal and abandoned agricultural lands suitable for biocrops around the world and also within the US. In particular we have been looking at Brazil.

In the area of food and fuel market impacts we have very interesting and important work going on in assessing competitiveness with Brazil and potential trade impacts, impacts of biofuels on food and energy. Modeling global oil prices in response to transitioning to a biofuels economy, assessing and modeling carbon and greenhouse gas emission costs, and developing trade scenarios for corn and cellulosic ethanol using CGE models.

And then finally we have also in our ESC Dimensions research on societal and policy aspects. And again from both a global and perspective, keeping in line with BP's goals for this research. Again, very important, interesting and relevant to the big picture. I don't think that you can move forward in this area without really looking at all of these topics.

And again just to highlight the

diversity. Intellectual property rights, food security, global conflicts in the shift toward biofuels, et cetera. They're there and again they are on our website.

And I'll end -- We just have a couple more slides. We have been funding a lot of activities this past 18 months, many in -- We have funded a lot of workshops in various areas and have contributed significantly to conferences covering biofuels and there's a list of them here. Many of these have, reports were generated and are available. So our goal here is to bring together the key stakeholders in these areas. And under various disciplines so that they can understand what the other groups are doing as well.

And then in addition to our basic research. All of the partners, UCB, UIUC and LBL are very much dedicated to developing and implementing education outreach programs. Certain aspects are already in place. Here we are interested in opening up our facilities and our research and the intellectual resources to visiting scholars.

We want to develop programs to education really the next generation of what we need of

energy scientists at the post-doctoral level, PhD and undergraduate level.

Educating the public. This is I think really key, as many of us who are biologists learned in the GMO efforts that probably weren't handled as best they could have been a decade or so ago.

And it will be particularly important, especially in educating the public again to ensure that the individuals that are called upon later to make key decisions regarding bioenergy and biofuels can do so with adequate information and make informed choices. I think that that's where the mistakes have been made in the past.

And I'll end with some contact information. Our website, energybiosciencesinstitute.org, or you can send requests for any material to ebi@berkeley.edu.

It's also, I would just like to say that our partnership with BP focuses on bioenergy and biofuels. Again, as viewed by the global lens but the models, the assessments and the research we publish hopefully will be applicable to US and state biofuels efforts as well. Thank you.

DR. TIANGCO: Thank you. Any questions

from the Commissioners?

PRESIDING MEMBER BOYD: No. I just want to thank you. And I am particularly interested in, well I'm interested in practically everything you said but the modeling oil cost thing. You are liable to hear from us more about how much you can talk to us about that issue. Nobody anywhere seems to be able to accurately predict energy costs.

DR. S. JENKINS: Well another interesting area there is transitioning. As the economy transitions and looking at past experience in the oil markets from private oil companies to nationalization and what lessons were learned there and what we need to sort of be prepared for as our energy sources shift here in the United States.

ADVISOR BROWN: Could you speak into the microphone, please.

DR. S. JENKINS: Sorry. Do I have to -- I don't know if it's on.

PRESIDING MEMBER BOYD: Do you have a green light on?

DR. S. JENKINS: Now it's on.

PRESIDING MEMBER BOYD: Now you do.

DR. S. JENKINS: I would also like to say that almost everything under our social, economic and environmental program received an exemption from BP for the 30 day preview period. So that is information that there isn't a lot of IP attached to it so we are perfectly happy to make that available on an ongoing basis.

PRESIDING MEMBER BOYD: Thank you.

DR. TIANGCO: Our last speaker for this panel is Tom Jacob from DuPont. And he will be sharing the things that are going on at DuPont with regards to biofuels research. Thanks, Tom.

MR. JACOB: Thank you very much. I appreciate the opportunity to share with you some of what DuPont is doing in the biofuels area. We have a very strong belief in this area and its import going forward into the century. We expect to be a significant player in that. Let me provide one caveat in advance. I am not embedded in the technical side of this so there are limits to how deeply I can get into it in the event of questions. Let's get going.

We have a mission that we have incorporated into DuPont of increasing shareholder value and societal value while reducing our

environmental footprint. Not only within the company but along the value chains in which we operate.

And with respect to that footprint we have certain parameters around that. But what this reflects in a real sense is a very dramatic transition that our company has been in the midst of for the past 15 years or so from one of the largest chemical companies on the plant to a company that is very, very deeply embedded at the interface of biology and chemistry.

And very deliberately so. We believe that that's where a lot of the solutions come from, not only in the energy area but in areas related to food and agriculture, industrial production, biological production, industrial chemicals. We are involved in a number of different aspects of energy, solar, wind, fuel cells. And of course the topic that we are about today, biofuels.

We do believe that biology will help reduce the global reliance on fossil fuels.

We believe that we can deliver solutions that are sustainable, renewable and that match real-world needs. That will integrate modern

biological tools into world-renowned chemistry and engineering, as well as delivering renewable-sourced chemicals and fuels.

We in essence are following a three part strategy here. First, to improve existing ethanol production via differentiated agricultural seed products and crop protection. Then to develop and supply the next generation of biofuels with improved performance. and also, of course, to develop and supply new technologies to allow conversion of cellulose to ethanol. We believe that all of these are integral to making progress and delivering it as rapidly as possible.

With respect to the improvement in ethanol yield. We think this is important. We own, one of our companies is Pioneer Hi-Bred, which is perhaps the leading corn and soybean seed production company in the world. Specifically delivering into the marketplace today over 170 branded ethanol -- branded hybrids specifically developed to yield maximum levels of ethanol.

We are also actively involved in improving corn grain composition to increase ethanol yield, offering at the same time more valuable food and feed co-products.

And because we are so intimately involved across the spectrum of these we are also very attentive and very involved with improving supply chain efficiencies to better link farmers and ethanol producers.

And a derivative of our historic business in the crop protection area we are also focusing particularly on the protection of biofuel crops to maximize yield.

We do have a partnership of some note with BP for the production of biobutanol. Biobutanol formulations we believe deliver good fuel characteristics, high energy density, controlled volatility, sufficient octane to really deliver what the market requires, low levels of impurities.

The performance benefits of biobutanol we believe are several. Energy content closer to gasoline.

The opportunities to add more biofuels to gasoline.

It can easily be used with the existing infrastructure. It doesn't require a separate infrastructure. Gasoline blended with butanol is less susceptible to separation than ethanol-

gasoline blends.

And it is compatible with current vehicle and engine technologies.

We believe all of these represent enhancements that will enable the fuel to really deliver value versus ethanol.

Our partnership began in 2006. It is based on the foundation of green-based ethanol. We do have our biobutanol in pilot scale scheduled for 2010 and we expect commercial scale production of it in 2012. We are already involved with such things as testing of the fuel. Most of the development work is occurring in Europe.

But we believe there are other benefits as well. The greenhouse gas benefits are at least as good as ethanol. Low vapor pressure is lower VOC problems.

It does have synergy with ethanol. Existing ethanol capacity can be retrofitted to butanol production as was alluded to earlier.

The same agricultural feedstocks as are used to produce ethanol can be used.

The reduced vapor pressure actually offers opportunities for co-blending with gasoline/ethanol blends to a favorable advantage

and also from an octane standpoint.

One of the questions that we think is relevant, it has been alluded to several times, it relates both to the temporary ethanol production and potentially the production of biobutanol from similar crops, is the question of food, fiber and fuel competition. That has become a particularly key question this year. We think it's a relevant question but we think that the focus needs to be broadened a bit.

Some have suggested that agriculture cannot supply all of these needs. That governments need to be more actively involved in the choices between them. We think though that you have got to take a look at not just some of these emerging questions but the larger issues around productivity and yield and the benefits that are accruing in that.

Over the past decade we have seen a 13 percent growth in global population, a 36 percent growth in income. Well that could be 18 percent now.

(Laughter)

MR. JACOB: A 21 percent growth in meat consumption, 34 percent in corn consumption, 52 in

soybean consumption. But that growth has been supplied off only a six percent increase in crop area delivering those products.

The benefits from the yield in this regard are very significant. In the last 25 years improved corn yields from existing acres in the US have resulted in corn production that would have required an additional 150 million planted acres had yields not improved. In essence a virtual 150 million virtual acres had been created as a result of this increase in yield.

And we think this is an aspect of the food/fuel issue that needs to be taken into account as we try to parse through some of the questions that are occurring in the area of biofuels. We don't think that this is an either/or debate. We think that policies need to focus on greater agricultural productivity. Especially, we would add, in the developing world. We think that expanded agricultural production will expand health, stability and economic opportunity.

Finally let me get into our work in the cellulosic area, which we find very exciting. We have just this year, or just last year actually,

entered into a $140 million joint venture with the Genencor division of the Danish company Danisco.

That is aimed at commercializing a leading technology for non-food-based cellulosic ethanol production.

The intent is to license the technology package, the leading edge technology package directly to ethanol producers.

Establishing regional cellulosic ethanol affiliates in the process to help deliver some of this technology in other regions of the world.

The technology package that we are developing can be used as a bolt-on to existing ethanol plants to expand capacity in accepting cellulosic feedstocks.

The technology package can be a design-basis for a stand-alone cellulosic ethanol facility.

We have broken ground. We will be operational on a pilot scale this year, focusing on corncobs and switchgrass.

And we anticipate commercial scale production by 2012. A lot of the work and background on this has been enabled as a result of DOE Renewable Energy Laboratory research grants.

The partnership will deliver significant pretreatment to separate the lignin from the plant cellulose.

The Genencor contribution will be enzymatic hydrolysis to convert the cellulose. Importantly, the enzyme complexes that they have developed we believe will yield about a 30-fold cost reduction for the enzymes, which will be very important in developing and advancing this to commercial sustainability.

And we also have novel technology to offer to ferment the sugars and make a very high concentration of cellulosic ethanol. In this case utilizing a proprietary biocatalyst based on (inaudible) that we have advanced quite considerably.

We believe that this will produce from corn stover at a pilot scale this year with commercial production in 2012.

As I indicated we think that this as a bolt-on can in essence expand the productivity of existing acreage and biorefineries by a third. A significant improvement.

The biofuels benefits could be in the range of 25 to 40 cents a gallon.

And significantly this is also yielding biomaterials like Sorona and Cerenol to reduce oil demand by sourcing those materials from non-petroleum resources.

So what we have is an advance on a very broad front here in the area of biofuels by our company and others. And for the purposes of California I think the take-away is simply that we have a strong belief that this is where the future needs to take us. And we have a strong belief that it would be to our advantage and hopefully to the advantage of everyone if we were right there at the front of the line. I'd be happy to answer any questions.

PRESIDING MEMBER BOYD: Thanks, Tom. I don't have any questions. I'd just comment for audience benefit that you were the individual in your company who introduced this agency to biobutanol quite a long time ago. We're glad to see you back here today.

MR. JACOB: Thank you very much.

DR. TIANGCO: Thanks so much, Tom. I think we can open up the panel for questions. But before that let's give a warm applause for these distinguished speakers for this panel.

(Applause)

DR. TIANGCO: What I would like to do for the questions is take questions first now and then we'll do the on-line chat and also open up the phone for questions. Any questions? Ken.

MR. KOYAMA: Hi, Ken Koyama with the Energy Commission. A question for Bryan, Harvey and Susan. You mentioned a number of research areas that you are going to be working on but what about the time frame? When can we expect some results, for example?

DR. B. JENKINS: You want me to start?

DR. S. JENKINS: Bryan is used to these questions.

DR. B. JENKINS: Well, being good academics we have already accomplished some things and have some results. So it depends on what you want.

MR. KOYAMA: We have got very aggressive goals to meet.

DR. B. JENKINS: In terms of trying to satisfy the goals within the Bioenergy Action Plan, AB 32 and 118 and others. You know, I am not going to make any great predictions about when we are going to see large-scale production of

biofuels to meet these demands.

I think we are all hopeful that we will make some progress on these but I think it is going to take some time to get facilities built at the scale that we think that they can be economic so it will be perhaps some years before we see this. But I think if we don't, if we don't take some risk, I think -- we have been pretty risk-averse in this area. We have been very cautious in the way we have proceeded. Not just in the biofuels area but the renewable area in general we have been very cautious.

And I think we don't need to be so cautious. I think there are some things that we can do in the way of proceeding to provide some, some compensation for the risk perhaps that will allow us to fail better than we have been able to do so far.

So I think we will see some move forward, particularly coming out of these DOE programs as well as the in-state programs. Where we will see certainly some more development within the fairly near future. I'll just say that.

DR. BLANCH: We sort or established a five year time frame. We established a five year

time frame that was part of the DOE support. We are pretty much on track to have the technology developed, we feel, within that time frame.

The translation of the technology into pilot and then commercial facilities is obviously going to take much, much longer. But we hope by partnering with industry early on that will shorten that time frame.

DR. S. JENKINS: I think I just have to echo Harvey's time frame. In partnering with BP, they are already establishing some of the infrastructure to test what we will be developing over the next -- I think they were looking at a three to five window, a three to five year window for something substantial.

DR. TIANGCO: Any more questions? Steve. Please identify your name.

DR. KAFFKA: This is Steve Kaffka. I'd just like to make a comment about that question, Ken, because I think it's a good one.

My own view is that in the short- to mid-term, the way that California can develop liquid transportation fuels is primarily from agricultural-based sources and possibly also forestry-based sources. But if we create

regulations that effectively prohibit the development of some of those opportunities we won't have those fuels.

DR. TIANGCO: Sharon Shoemaker.

DR. SHOEMAKER: Thank you very much, Val. I appreciate this opportunity to be here today and commend the group that's giving presentations. And the part of this that is near and dear to my heart is in the biochemical approach to this area.

But first I have to just say, what a day to do this. This is the day that one of our Californians is perhaps being confirmed as the Secretary of Energy nationally so I think this is quite a day to have this meeting.

Then moving on, especially to the group at Berkeley. To ask one area. This is not addressing the question of near-term and reaching the goals as much but in the broader sense to capture, if you will, the power of biology. In this one area one approach wasn't mentioned and I wondered if you were working in this area. I know some other campuses are.

And that is in the area of direct biological conversion, that is from CO2. So not

using plants. In this case not using land acreage but using, if you will, fermentation like the pharmaceutical industry but in some new reactor design to take CO2 to products other than ethanol typically.

And this is work that is going on at UCLA, at one place, James Leal. Gevo, a company. It's a start-up that has started but it's kind of -- I think it is very interesting in doing metabolic engineering. That's the fancy word of how to redesign microorganisms.

And we really know so little about our microbial work today that therefore there is a lot of potential to really harness this. And now with the tools that we have we could, I think, really develop this further. Are you -- I mean, that wasn't mentioned and we're talking about plants, crops in this and some of the inherent complexities. If you'd comment.

DR. BLANCH: There is some activity in this area at Lawrence Berkeley National Lab but none other I am aware of of the sort, apart from fixing CO2 using micro-algae on campus.

MR. SHAFFER: Steve Shaffer, a couple of questions. One for Susan. And again it gets back

to the timeline. We are all anxious on results from research and what have you. But especially in terms of the effort on the socioeconomic issues. Anything to anticipate coming out on indirect land use effects that might be timely for the discussion that is going on at CARB?

DR. S. JENKINS: Yes, actually. There is a draft review of write-up from a meeting that was held just before the winter break. It was a meeting with Michael O'Hare and representatives from CARB on discussing the -- the name escapes me. I have it on me, I'd have to look it up. Somebody from Purdue. On the lifecycle assessment of the greenhouse gas issues on corn versus other products.

MR. SHAFFER: Good, thank you.

And my question for Harvey was more of a technical one. The table you had. It's the bottom slide on page six of your handout. Comparing the cost of sugars from different sources. And sugar cane you seemed to use different parameters that aren't directly analogous to how you compare them to the other feedstocks, you just used the world price for sugar. It looks like presumably you are just

looking at the available sugar in the juice and not counting the biomass as well so the cellulose and hemicellulose -- Any comment on that?

DR. BLANCH: Yes. In Brazil typically those components are used. They are combusted to provide energy for the distillation of the ethanol. So yes, I just used the world sugar price. The US one because of the tariff is a little misleading. It roughly doubles to a little over 20 cents a pound.

MR. SHAFFER: Sure, if it is just direct refined sugar.

DR. BLANCH: Yes.

MR. SHAFFER: But if you are looking at sugar cane as a cellulosic biomass feedstock for second generation fuels it would see that that might come down to similar to miscanthus or poplar.

DR. BLANCH: Potentially, yes.

MR. SHAFFER: Okay, thank you.

DR. TIANGCO: Jim McKinney.

MR. McKINNEY: Jim McKinney, Energy Commission staff. I had a question for Dr. Jenkins. I was quite intrigued by the social and environmental research component you described

there. And is your institute doing any work on sustainability standards per se? So specific sustainability protocols or best management practices, say akin to the round table on sustainable biofuels. Say practices or certification procedures that can be applied at the global scale.

DR. S. JENKINS: Oh boy. I would say very likely touching on aspects of that. I can't, nothing specifically comes to mind. I don't know. I mean, my knowledge of all the programs and projects isn't as deep in all of the areas. But it's certainly something that I could put you in touch with the groups or we could talk about it afterwards.

MR. McKINNEY: Okay. I'd appreciate that, thank you.

MR. JACOB: I'd like to just, if I could chime in on a couple of these points. Because I think these issues around the indirect impacts are clearly, you know, very current, not only here but globally. And they are also very, very complicated. And I think we are all going to have to do a lot of focused thinking to get, to get through them.

But our view is that there's a lot of factors that influence these land use decisions, particularly when you are considering this on a global scale. Population growth, changes in living standards, standards for agriculture, traditional subsistence farming, demand for minerals and the like.

One of our concerns here and one of the reasons why we think we need to make sure we somehow put this in the context of the larger enhancements in yield and crop productivity, if we are going to make rational choices here, is that we are concerned that we not kind of drift in the direction of a default penalty for agriculture-based biofuels.

We have got to sort this out in a way that enables the most rational path forward that integrates not only the interest in replacing or displacing significant amounts of petroleum but recognizes the opportunities to enhance agricultural productivity. The necessity of doing that really in many parts of the world.

And if you look at comparisons of agricultural yield across the world you find that there's enormous opportunities for enhancing

agricultural productivity in many of these places where we are expressing concerns over these indirect land use impacts. It raises lots of questions about whether we are delivering as much as we can in the way of increasing productivity on the ground, in the agriculture that's already in place in these countries. If we are not then that's affecting more pressures. Why is that?

These are not simple questions. They are very, very important questions though and they have significant implications for the growth and development of biofuels in our view.

And we also had some discussion and questions about timing. And one of the reasons -- Well there are several reasons why we are heavily involved with corn, not least of which is we know a hell of a lot about it. Not just us as a company but certainly us as a company, but nationally. And that knowledge can be very enabling. So can the existence of the supply chains and the systems that are already in place around corn production, harvest, storage. As well as the utilization of corn in ethanol production.

So in terms of enabling the maximum progress in terms of this transition. And really

that is what this is all about is the beginnings of the transition toward a more sustainable fuel culture. We think that that's one of the reasons why we should continue to try to leverage what we have already accomplished in the area of some of the significant commodity production crops and get the most we can out of them. Because we think we can deliver much more rapidly there because of the knowledge base we are building off of, as well as the infrastructure and supply chain issues associated with that.

DR. S. JENKINS: I would also like to make just a comment. About the EBI in general and our direction. I think the leadership of the EBI has discussed this, all of these aspects, all these topics many times. And I think that what our position is is that we are not about lignocellulosic biofuels or bust. We are about biofuels if they can be done right.

So yes we are positive or we are forward-thinking about it. We feel that there is room. That things will progress as they need to progress. But I think that's the importance of doing all of the research together so that if somewhere along the way a flag goes up you, you

see that flag. And then you step back and you look at the issues and examine them.

So we are not, you know, advocating that, you know, that it has to be biofuels for transportation fuels. It could be biofuels for alternative energy production. But we are only a year into our program pretty much. Our researchers really started receiving funding within the last six to eight months. So we have a significant amount of work to do also.

DR. TIANGCO: I have a question for John Scahill or Don Stevens. Are you on-line?

DR. STEVENS: Don is still on-line.

DR. TIANGCO: This is with regards to Section 932 commercial scale biorefineries.

I thought IUGen (phonetic) is ahead of the game and I don't know what happened, why IUGen is out of the commercial scale biorefinery support.

DR. STEVENS: IUGen withdrew itself and I am not entirely sure of the reasons. You have to ask IUGen to be certain about that. They formally withdrew from the competition.

DR. TIANGCO: Thank you. Any questions from the audience?

I think we can entertain questions on-line. Okay, the first question for all speakers. Based on the growth rate and ease of growing algae it should be our main focus for economic and sustainable alternative. How is it that it is competitive at a cost of $3.22 a gallon? With a 20 percent profit margin I think you will be selling it at $4.50.

DR. B. JENKINS: Can you repeat the exact question.

DR. TIANGCO: Based on the growth rate and ease or growing algae -- I'm reading it. It should be our main focus for economic and sustainable alternative development. How is it that it is competitive at a cost of $3.22 a gallon?

DR. BLANCH: Algae has been examined for the past 40 years. There are only two commercial algae facilities making products in the US, Syanotech and Aquasearch were. One of the big issues is dewatering the algae because of the their small size.

And the second is simply the amount of water that must be used in growing algae. For example, a modest algae biorefinery, say making

10,000 barrels per day of oil, will process approximately ten billion gallons of water per day. The largest wastewater treatment facility in the US is one billion gallons per day.

So the current productivities, which are actual productivities measured in the field, not in the lab, would suggest that algae will not be a suitable organism for making biofuels.

DR. TIANGCO: We will unmute the phone. Whoever asked this question you can do the follow-up question. Are you on-line?

MR. RAIN: Yes I am.

DR. TIANGCO: Okay. Can you speak up and raise your follow-up question.

MR. RAIN: Yes, sorry about that. Okay, so you are saying it would take so many gallons in order to create -- And certainly that is an excellent point. That's the reason this should be doubled as a water-treatment facility for even just California in general needing so much water.

I mean, we are not talking like we have to really make the water -- We have so much bad water out there. There's oceans of it. Can it still be possible?

DR. BLANCH: One of the issues with

algae is their size. They are very small. Most of the algae you would like to use for producing biofuels are around five microns. The only way you can separate them from water effectively is centrifugally, which requires processing these huge volumes of water.

MR. RAIN: Okay.

DR. BLANCH: You can't filter them effectively. It has to be done at a very high-cost process. So regardless of the quality of the water, the amount of water to be processed is simply so high it has precluded always the commercial production of algae.

MR. RAIN: Is that electrical costs?

DR. BLANCH: Yes, electrical costs.

MR. RAIN: Okay. Okay, thank you. I appreciate that.

DR. B. JENKINS: I want to just comment on this algae harvesting question that there are some other techniques. For example there was a technique developed by David Brune which uses fish to harvest the algae and then harvest the fish. I don't know if we can use fish as a biofuel feedstock but that's potentially one way to do it.

MR. RAIN: Okay, thank you.

DR. TIANGCO: The other comment is from Shirley Johnson. Again with regards to algae. I will read: The algae conference in Seattle was showing a cost of around $50 per gallon to produce the closed system. Open pans are currently operational but are climate-prohibited. That's why we shouldn't use pans. Vertically built bioreactors are much more practical. I guess that's a comment rather than a question.

Are you on-line Shirley?

Any more questions from the audience? I guess that's it. I'll give the floor to Ken for the company presentations unless the Commissioners have comments or questions.

PRESIDING MEMBER BOYD: No, no questions. I just ended up with the blue cards, of which there are two.

MR. KOYAMA: You can do it.

PRESIDING MEMBER BOYD: There's a third coming from behind you. I'm going to pass them down to you and I'll let you do it.

MR. KOYAMA: So again, the ground rules are about a five minute presentation per company, please. The first one is Jeff McElvaney, director of marketing for Proterra Bio.

MR. McELVANEY: Good afternoon. Thank you very much for the opportunity to speak to you all, the Committee and the Commissioners. I appreciate the opportunity to share a little bit of information about our company. Again, I'm Jeff McElvaney, I'm with Proterra Bio. And basically we are an advanced form of anaerobic digestion.

The technology is not brand new. It's been in commercial operation for a total of about 15 years starting back in Hawaii. The technology was developed back in 1984 in a prototype plant on Waiamau, Hawaii, Oahu. And it was funded originally by I think it was Washington Energy back then. And they explored the technology and implemented it in a horizontal tank format. And after a period of years the technology person took his technology and went to another investor.

And at that point it took on a second generation form on Maui, on the slopes of Maui. And that was to demonstrate the commercial scalability of the technology.

Basically the advanced anaerobic digestion, if I can just sort of paraphrase since I am not scientific, I'm just marketing. The process is we are able to accelerate the

processing rate of digestion. And it is not in a typical stand-alone sitting tank like you see in a typical, classic anaerobic digestion form.

The processing rate is increased to approximately double, basically cutting your costs in almost 50 percent. And what happens is it leads to a smaller project site. It also leads to economies of scale in taking it to market.

Basically we can take any multiple organic waste feed input, any kind of biomass, and process that. We can turn out any kind of flexible fuel, butanol, ethanol. Hydrogen even is what we are exploring as well.

And just to back up, the technology has existed in commercial operation for about 15 years. The most recent experience that the technology person had with the technology implementing in commercial operation was in Los Angeles, California back in 2004 when the technology was awarded the first renewable contract with the LA Department of the Water and Power. And at that point it was scheduled to go in in Lancaster, California and to provide 40 megawatts of renewable energy to LA by the year 2008.

Unfortunately due to some business operation issues the contract went null and void and so the technology is now getting into a sort of dormant stage and we are coming out with a third generation system now and we are ready to go.

So not to over-tout but our position but the commercial scalability of the project is viable today. The technology is ready to go now. And we can start off with one fuel and adjust the process and produce a secondary fuel or a third type of fuel as the market changes. And so we are very interested in pursuing interest in California. We are going to be developing more projects in California and we are available to speak to the Commission if it seems necessary.

We are very open to questions. I'd prefer to put you in touch directly with our technology person since he will be able to explain a little bit better. But he has been the source of the technology and received the patent on the technology. So again, thank you very much and I'm from Proterra Bio, thanks.

PRESIDING MEMBER BOYD: Thank you.

MR. KOYAMA: Any questions from the

Commissioners?

PRESIDING MEMBER BOYD: No but I have a feeling some staff will be contacting you with questions later.

MR. McELVANEY: You've met Jim McElvaney, I believe. A couple of years ago I think.

PRESIDING MEMBER BOYD: Yes. I just was mentioning to Susan, these folks were here quite a while ago.

MR. KOYAMA: Okay, our next company is Dave Rubenstein, chief operating officer for California Ethanol and Power, LLC.

MR. RUBENSTEIN: Good afternoon. I want to thank the Commission for allowing me to spend a few moments with you. We are doing a sugar cane to ethanol facility down in the El Centro area. We have been moving along pretty good for the past two years. We are in the permit process now.

We recently just changed our engineer/ constructor to Fagan who has built 50 to 60 percent of the corn ethanol plants within the United States. They became an investor in our company as well.

Our model is pretty much the same was as

Brazil has been doing it to the effect that we are going to squeeze the juice out of the cane, make ethanol out of it and then use the bagasse as a fuel source for our co-gen facility. That's about where it ends as far as the Brazilian technology goes.

There's, you know, quite a bit more environmental aspects that we need to look at and we are actually pretty excited about it. We are looking to build multiple plants. The first one should produce about 60 million gallons of advanced biofuel and about 50 megawatts of electricity, half of which would be provided back to the grid as green electricity.

We are working with SCPPA right now to do the off-take of that as well as IID. Excuse me. I don't get in front of crowds too often.

One of the other things that happens in Brazil is they take the vinasse and they just simply put it back in the fields. Well we found that we can't do that and we found actually opportunities for that.

We think we could recycle a considerable amount of the water from that application and use it within the plant. Our goal is to get water-

neutral if at all possible within the plant.

We will also produce some organic and inorganics and we will produce some fertilizer. And we think we will also have an anaerobic digestion system on there that will either get us some biomethane or -- we're talking with Air Products in terms of putting a fuel cell technology on it and possibly having a hydrogen off-take.

In Brazil they typically burn the crop and the field trimmings are gone. We are going to collect the field trimmings and we think they could go both as cattle feed as well as there's other biomass power facilities in the Valley that are interested in taking that as a fuel source for their facilities.

We are also looking at a CO2 offtake. We think there is a potential to capture the CO2 that's coming off the fermentation process. And we are working with a few companies right now to see if they want the industrial CO2 for industrial applications.

And then there's algae. We were talking to numerous people that approached us to see if they will take the CO2 for algae production. So

open book on that.

On the agricultural aspect we are pretty excited about it. We are working with a group of five farmers who have formed an alliance who are extremely excited about this program. It is going to double the amount of rent they get per acre. It is going to reduce their labor in the fields. They don't need to go and cut alfalfa nine, ten, twelve times a year. So they're really excited about it. It is going to bring a sustainable and predictable crop to the Valley for them.

We are looking at about -- Each plant should produce about 300 to 350 direct jobs. Most of those jobs would be well-paid operators. They will be working both in the ethanol plant as well as the power plant. So it is not going to be, you know, $8 an hour jobs. It's going to be pretty well-paid for folks.

One of the big issues we have to talk about is water and we have addressed that. As mentioned we think we can recycle a substantial amount of the water out of the cane that comes into the plant and use that in the plant. And our goal is to be water neutral.

As far as the cane growing in the field,

we are excited that it is not using much more water than the alfalfa or Sudan grass that is currently growing there.

We are excited about AB 118. We think that one of the proposals that we presented to the Commission was one that we would be looking for a possibility of a low-interest loan to get us through the development stage. Pay that back to the state with interest at financial close. And then possibly later a loan guarantee along with other federal loan guarantees to see if we could get this thing built, bring these jobs to the state and bring some renewable fuel in as well.

And I think that's pretty much it from my scribble notes. And again, sorry for the choking up. But if anybody has any questions I'll be happy to answer them.

PRESIDING MEMBER BOYD: You did fine so you can come before bodies any time. I have no questions, just a comment that having been at this for a lot of years I have been -- You sound promising. I have been hearing about Imperial Valley ethanol from sugar for more than ten years. I wish you luck.

MR. KOYAMA: Our final company

presentation is from Matthew Frome from Solazyme, Incorporated.

MR. FROME: I'm Matthew Frome, I'm with Solazyme. Thank you for giving me the opportunity to speak.

Solazyme is a renewable oil production company. We are also the leader in algal synthetic biology. We were founded in 2003, making us I think probably the oldest algal biofuel company in the world. We are a California-based company. We are located in South San Francisco.

And we are energized by the programs that the CEC is moving forward with and we look forward to moving our commercialization here in California.

Solazyme has a unique microbial conversion technology process allowing algae to produce oil in standard industrial facilities quickly, efficiently and at large scale.

To be clear, we do not grow our algae photosynthetically, at least for energy purposes. We do for some other products. But grow in standard, industrial fermentation facilities. I think we are the only advanced biofuels company

producing oil at scale in this way.

Using algae as a platform we have actually demonstrated feedstock flexibility, including cellulosic feedstocks such as corn stover and switchgrass as well as industrial waste streams.

In terms of fuels, Soladiesel I think is the first demonstrated fuel ever to be run at 100 percent, 100 percent algae fuel in any road test whatsoever. Soladiesel is a -- This particular one in my hand is a Fatty Acid Methyl Ester. It meets all of the specifications for ASTM D6751. And it has all the benefits of biodiesel but also includes a cloud of -7C, the lowest available.

We are also the first company ever to make a hydro-treated renewable diesel from algae. It also meets all the specifications for D975.

And so both of these fuels, although they do have slight differences in their use, both can be used in the current vehicle infrastructure.

Lastly I just wanted to mention that I actually drove up to this meeting in an algae Jeep, one with algae biofuel, so it is real. We will be taking part in the Target 2030 Conference, Transportation and Energy Future tomorrow and the

next day. We're part of the Ride and Drive. So if anybody is interested in driving in I think the only algae-powered vehicle in the world please let me know. Thank you.

(Laughter)

PRESIDING MEMBER BOYD: Is there a unique odor we should be looking for?

MR. FROME: There's none.

PRESIDING MEMBER BOYD: Okay, thank you.

MR. FROME: The oil actually can also -- we have actually some food applications. It actually tastes great. I've made brownies and all sorts of great things with it.

(Laughter)

MR. KOYAMA: Okay, do we have any on-line that want, any companies on-line that want to speak? No? Okay.

MR. SHIPLEY: Hello.

MR. KOYAMA: Okay, go ahead. Please identify yourself.

MR. SHIPLEY: Yes. My name is Greg Shipley with Bioenergy Development.

We have a -- We are a private company that has an agreement with the USDA ARS Lab in Albany, which is right next to Berkeley. And we

are presently in the process of building a four-conversion technology integrated pilot plant there on campus.

And one of the, one of the things that we are doing is using algae for, the co-production of algae from the fermentation process of a way of not really sequestering CO2 but absorbing CO2 as a byproduct from the fermentation process. This is the kind of closed look thinking that we believe an integrated biorefinery should have.

The other processes that we are incorporating are biological, biochemical and thermochemical. We believe that not one technology is a silver bullet for conversion of biomass into biofuels and biochemicals.

The one point that I wanted to make is that the pilot plant and our cooperative arrangements with the lab, presented today by JBEI and the BEI along with UC Davis and Cal Berkeley, is that we would like to share our power plant facilities with other groups. And also to share our data with state agencies like the Energy Commission and the Integrated Waste Management Board and CARB on air emissions and that sort of thing. We'll have a power plant facility where

regulators, whether it's from a commercial site application or from a state policy, you can come down and kick some tires. I think that about wraps it up.

MR. KOYAMA: Okay, thank you. Is there anyone else? Okay, I think we are ready for your concluding remarks.

PRESIDING MEMBER BOYD: Thank you. Well first my first sincere concluding remark is to thank all of our participants today for their participation, for their contributions to the ever-growing body of knowledge on the subject. And I find days like this quite enjoyable, fascinating and educational.

Thanks to the stakeholders who added both their questions and additional comments.

And I want to thank Ken in particular but all of the staff who worked on this. It was a lot of work to seduce many of you to this table to talk about these various topics and we very much appreciate it.

For those of us who have been at this for a long, long time, you know, we get anxious about wanting to move this along. But by the same token I appreciate the caveats today about, we

need more time. I really wanted to ask those who said, three to five more years, or just to comment, but I have been hearing that for three to five years. I didn't say it.

(Laughter)

PRESIDING MEMBER BOYD: But nonetheless I recognize that this is complex, it takes a lot of effort. We try to convey that there are very strong policies in place in California that hopefully provide some kind of drivers or forcing functions from folks or to convey to their, to their leaders that there is an extreme interest in this.

We have kind of today almost ignored the financial world that we suddenly are living in and trying to hope that maybe that will go away real quick and we can keep on going. I know it won't but at least -- There were a few references and a few comments about what's happened already.

The good news so far, I'm almost afraid to say this publicly for fear that it will bite me, but the good news so far is that the 118 program has not been adversely impacted by California's financial dilemma. And we hope to at least do our part as government to participate in

consenting, encouraging -- development and demonstration is almost priority one for us. But research and development is a necessity as well.

Aside from the 118 program our Public Interest Energy Research activity here at this agency has for years and will continue to invest pure R&D to the extent it can and leverage its funds in some of these same activities. A lot of the things you hard about today have had our involvement in the past.

I do think that we need to step it up. And it is hard to say in the face of the financial situation. I too am encouraged if not downright giddy over the fact that Steven Chu is going to be our Energy Secretary. We have great familiarity with him as we do with the whole University of California system, particularly the University of California, Berkeley. And he knows our state, he knows what's going on and hopefully it will be reflected in some of what we need to do.

I mean, I feel very strongly. We need to divest ourselves along multiple bioenergy and other alternative energy paths. We concentrated today on biofuels but bioenergy in general is of extreme interest and a very strong need for us in

the state if we are going to barely remain the golden nation-state of California. And therefore anything we can do to encourage, incent within reason, we will be doing as an agency.

I must admit there is no question climate change is the biggest driver we have seen. It has brought with it lots of issues about indirect effects of things and the carbon footprint question and so on and so forth. And this agency along with the Air Board, the staff's have been wrestling together and independently with this issue.

We have been driven very -- The Air Board I know is driven very hard by the Low-Carbon Fuel Standard. We have been driven even harder because we have got to get this AB 118 program launched. The legislation required regulations, it required an Investment Plan that was to be prepared with help from an Advisory Committee, and it very specifically cited sustainability and all that that entails.

I see Tom Jacob has -- There he is. Your almost closing comments there a few minutes ago. I almost made a comment and I didn't and I am going to make it now. In that I took to heart

what you had to say and you said it in an exquisitely diplomatic way, far better than I might be able to, with regard to the issue of food versus fuel.

You know, a lot of us have reacted to that fairly negatively, some even more so. There's been a lot of knee-jerk reactions. Thou shalt not. You won't spend any money at all on energy crops with any of the money you have. And yet you heard today you can, you know, there's way to salvage land with some kinds of crops, et cetera, et cetera so don't totally slam the door on it. And I heard you say that research in this arena might actually bring some net positive rather than net benefit. So hopefully everybody is open-minded enough to know.

I mean, I looked very deep into the issue early on of folks in Mexico paying more for their tortillas as a result of the early -- And you know that's white corn, we produce yellow corn. There was a market reaction. And it's hard to control markets. But it wasn't a direct, you know, withdrawing food from people's mouths kind of an issue.

Now I am not much of a proponent, if any

proponent of corn to ethanol because I have much higher priorities personally associated with using the California, quote, wastestream. But I also like to think that I am very open-minded and that this agency is very open-minded. It takes a little grief once in a while from folks when we're trying to be open-minded.

But in any event to me this contributed to the knowledge we have. And I wish you all well in the work that you have underway and I just hope we all can move the issue forward.

Pardon me for that long closing remark but that's where I'm coming from. Commissioner Douglas.

ASSOCIATE MEMBER DOUGLAS: Thank you. I will balance your closing remarks with a very brief closing remark of my own. I'd like to join Commissioner Boyd in thanking the participants and the stakeholders who were here today with us.

I also see biofuels as an important part of California's future transportation fuel mix and we are working hard here at the Energy Commission in a number of ways to understand better how that change can take place and how we can help facilitate it.

I would also like to -- It was very helpful to hear from folks here, particularly the private sector about what you are actually doing to advance biofuels research, and particularly cellulosic and other forms of biofuels.

I would like to encourage everybody to think about how to identify and to some extent quantify some of the environmental benefits that can be achieved through at least certain kinds of biofuel production. And also to do as we are doing and as the AB 118 directs us to do, to deal with sustainability issues and concerns up front.

And think about criteria and think about goals and think about, you know, depending on the environmental footprint -- I'll just say, the environmental footprint of a fuel that is produced probably does and will impact the extent to which it can be widely deployed. So it is going to be a fundamental part of our considerations and hopefully will be of everybody's considerations as we move forward looking at biofuels and other transportation fuel options.

So again, thank you very much. I was pleased to be able to hear from so many people on such a wide range of issues.

PRESIDING MEMBER BOYD: I'll leave it to you to conclude the session, Mr. Koyama.

MR. KOYAMA: Okay, thank you.

With that, that concludes today's workshop. I appreciate everyone's participation in this. As Commissioner Boyd said, some of you were contacted at the very, very, very last minute and graciously decided that you could make it so thank you all very much.

(Whereupon, at 4:36 p.m., the Committee Workshop was adjourned.)

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CERTIFICATE OF REPORTER

I, RAMONA COTA, an Electronic Reporter, do hereby certify that I am a disinterested person herein; that I recorded the foregoing California Energy Commission Joint Committee Workshop; that it was thereafter transcribed into typewriting.

I further certify that I am not of counsel or attorney for any of the parties to said workshop, nor in any way interested in outcome of said workshop.

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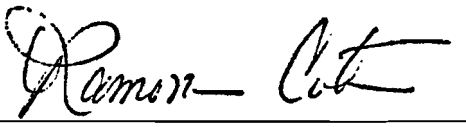

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