UNIVERSITY OF CALIFORNIA

BIOLOGICAL AND AGRICULTURAL ENGINEERING

CALIFORNIA BIOMASS COLLABORATIVE

SECOND ANNUAL FORUM

VOLUME II - BIOFUELS AND BIOPRODUCTS

CALIFORNIA EPA BUILDING

BYRON SHER AUDITORIUM - COASTAL HEARING ROOM

1001 I STREET

SACRAMENTO, CALIFORNIA

TUESDAY, MARCH 1, 2005

10:00 a.m.

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P R O C E E D I N G S

10:00 a.m.

MODERATOR VON BERNATH: Good morning. Thank you for coming for the biofuels and bioproducts. My name is Hugo Von Bernath; I'm a Researcher for the California Biomass Collaborative. I have been working this program from the beginning. I'm the only one researcher has been the full two years working in this area.

I've been asked to present this session called biofuels and bioproducts. And it has been a very -- now I have to present Professor Joan Ogden from the University of California in Davis. She is an Associated Professor of International Environmental Science and Policy at the University of California. And Coordinator of the (indiscernible) Pathway Program at the Campus Institute of (indiscernible) Studies.

Her primary research interest is (indiscernible) and economic assessments of new energy technologies, especially in the areas of alternative fuels, fuel cells, renewable energy and energy conservation.

She's recent works centers on the use of hydrogen as an energy (indiscernible)

infrastructure strategies and application of fuel cells technologies. I will not read the full length of her work, it's very interests and very long.

So I will leave you with Dr. Joan Ogden.

(Applause.)

DR. OGDEN: Thanks, Hugo, and good morning. I'm going to talk a little bit today about a long-term energy carrier that could find use in the energy sector and transportation. And talk a little about the possible tie-in with biomass, as well, although a lot of this talk is going to be about hydrogen.

First of all, why would you consider hydrogen as an energy carrier. There are lots of different energy carriers you could make, liquid fuels, electricity and so on. And some of the reasons this is getting so much attention these days, first you can have zero or near-zero emissions at the point of use, in a vehicle or in a stationary power fuel cell.

There's also the possibility to load a zero well-to-wheels emissions that both air pollutants and greenhouse gases. And by well-to-wheel meaning all the emissions involved with

extracting the feedstock, making it into a fuel, transporting that fuel to users, and then using the fuel in a car.

Hydrogen can be made from lots of different resources, fossil, renewable, even nuclear. And it's widely used today in chemical industries. About 2 percent of world primary energy use actually goes to hydrogen production today. So there's a strong technical base for making hydrogen, at least from fossil fuels. We know how to do this on large scale; we know how to store hydrogen; we know how to deliver it in trucks and pipelines.

And also there's been a lot of rapid progress in hydrogen and fuel cell technologies that's caught a lot of people's interest. In fact, some people even see fuel cells as disruptive technologies that could change the way we produce and use energy.

Also there's mentioned these new products and services. And for example Larry Burns at GM, who is one of the people behind the autonomy and other designs there, sees the possibilities of actually mass producing cars at less cost and having new services, onboard

electricity and so on.

So I guess to summarize, the reason people are interested in hydrogen, it's one of the only long-term fuel options that could allow radical reductions in greenhouse gases, air pollutions emissions and oil use all at the same time. It could do the triple play. And the others that could, I would say, are liquid biofuels or electric battery vehicles.

But there are a lot of barriers to realizing using hydrogen on a large scale, also. There's current lack of a widespread infrastructure; although there is a fair amount of infrastructure to deliver hydrogen for chemical uses, we do have pipelines and trucks, it's certainly not delivered to every refueling station in the country.

Current high cost of hydrogen end-use technologies. Fuel cells, for example, are still pretty expensive. Technical maturity. We have hydrogen technologies that have been developed in the chemical industries and so on, but the ones you'd need for energy economy such as fuel cells, hydrogen storage for vehicles, small-scale hydrogen production and low-cost zero-carbon

hydrogen supply still need more development.

And then there's the chicken-and-egg problem, as they call it, for vehicles, which really is about matching supply and demand during a transition if you have a rapid growth in use of a fuel. Car manufacturers don't want to necessarily build a lot of cars unless they know their customers can refuel them. Refueling energy supply companies don't want to build refueling stations unless cars will come. How do you get over this hump? So, that's one of the things often mentioned.

And then finally, maybe most importantly for this and a lot of other renewable and clean energy technologies, is a lack of policies reflecting the external costs of energy at present.

Hydrogen, like electricity, is an energy carrier. You can produce it from a number of different primary resources: wind, solar, biomass. But also fossil fuels, such as natural gas or coal. And the idea of capturing carbon when you make hydrogen from a hydrocarbon like coal, then taking the CO2 and sequestering underground is an area that the DOE is paying a lot of attention to.

Now, with regard to biomass that's kind of an interesting idea. You could couple biomass with carbon sequestration. There you could take a hydrocarbon -- if you make hydrogen from something like biomass or coal or natural gas, you have to separate the CO2. You have to send the carbon one way and the hydrogen another. So you could perhaps capture and sequester CO2 from biomass and end up with a negative CO2 production out of that kind of energy system. It's kind of an interesting idea.

Just comparing for a minute fuel cycle greenhouse gas emissions. Really thinking about the greenhouse problem is one of the motivations of many motivations for looking at hydrogen. And what I've plotted here are the full fuel cycle or well-to-wheels greenhouse gas emissions. That's all the emissions in extracting the fuel, producing it and using it in a car.

And I have shown this for several different types of vehicles. It's all normalized to one here. And one is an advanced gasoline vehicle. You know, sometimes when you look at future alternative vehicles things like fuel cells, you don't want to compete them against

today's gasoline vehicle, you want to look at tomorrow's internal combustion engine vehicle or gasoline vehicle; give that the best shot and then try to do that comparison.

So, the current vehicle, then the advanced gasoline vehicle, and this assumes by light-weighting and some other improvements, you could get to maybe 46 miles a gallon; based on some simulations by engineers at Ford.

Then hybrids and gasoline, diesel, hydrogen, they're all kind of in the same ballpark. And then fuel cells. And depending on what you make fuel cells from -- hydrogen for fuel cells from, you get different well-to-wheels.

If you use a fossil fuel like natural gas, which is shown there, hydrogen from natural gas, you get a little bit better well-to-wheels performance in greenhouse gas emissions than you would with a gasoline hybrid.

But you don't start to really see drastic improvements until you go to either carbon sequestration where you can cut that down a good bit, or renewables. I've used wind as a marker. If you did biomass with sequestration you'd actually see that bar go negative.

Well, there are a number of these long-term visions for hydrogen, based on renewables, based on nuclear, based on fossil and sequestration.

With renewables I'd say the issue is really costs more than technical feasibility. Because we do know how to do a lot of these things; we could put them together into systems to make hydrogen biomass gassification electrolysis powered by wind or solar.

Nuclear. You have cost issues. You have technical feasibility issues if you look at systems, for example, that use some high temperature nuclear heat to split water. It's getting a lot of play in the DOE right now, but it really hasn't been tested in an integrated system yet. And also they're the same waste and proliferation issues you'd have with nuclear electric power.

And then the final sort of view of a zero emission hydrogen system is fossil hydrogen with CO2 capture. That looks like it could be a relatively low-cost add-on if you have a large fossil plant. But there's a lot that's still unknown about what happens when you put massive

amounts of CO2 underground in the geological formations.

So there are challenges with all of these zero carbon futures. Trying to just give you a sense of what, although hydrogen has a lot of attractions in terms of environment, there's still some challenges to be met.

Well, how long will it be before hydrogen would start to make a difference. There was a study that the National Academy of Sciences did on this topic recently. And this shows several different views.

Hydrogen demand, and we're plotting here now from the present time up to 2050. And on the Y axis is hydrogen demand in tons of hydrogen a year. And on the other side is the fraction of vehicles that would be served, 50 percent, 100 percent level.

And these are four different scenarios that were done by the DOE. And as you can see, they vary all over the place. We get to 2050 we're either going to have between 1 percent hydrogen and 100 percent. And why can't we do better with the projecting this, this number? Well, it depends on a lot of things.

For one thing the technologies are still very rapidly evolving, having to do with hydrogen. Things like fuel cells, hydrogen storage. The policy is not there that would push us in this direction. Even if you look at fuel cells meeting their long-term goals and so on, the economics alone are probably not going to drive you there.

There's a question about there may be market pull. I mean it may be that a fuel cell car with onboard electricity will offer you things that you can't do with a gasoline car, even a future gasoline car. And it may be that there'll be market pull. Some people really believe in this quite a lot within the auto companies and other places

It's interesting that within the auto companies almost all of them are doing some work on fuel cell or hydrogen cars. And some have put quite a lot of development behind this.

But it makes it quite difficult to project future demands. So, hence, the large range. And what you really have to say is we don't know how fast this market will grow. There are a lot of things that will have to be satisfied. Costs, performance, availability of

fuel and other things. And how that all plays out over the next 10 or 20 years is going to be very very interesting to see.

There are maybe several hundred fuel cell vehicles operating on hydrogen around the world at the present time. And there are more that are going to be coming to California. I'll talk a little about the California hydrogen highway network program, which I was involved with as being a member of a panel on making recommendations to the Governor on this.

Well, there are the scenarios for demand. And we don't really know how fast. But one question is do we have enough energy to meet this demand. And how are you going to supply hydrogen.

So, again, the same graph here. These are the different things. And I plotted next to that the percentage of current U.S. use you would need of primary resources such as natural gas, coal, wind and biomass, to make hydrogen for light duty vehicles, or LDVs. And in the case of wind it's not actually current use of wind; it's the resource with some restrictions. And similarly for biomass.

So what we see here is that we do have a number of different options for making hydrogen. To get to the 50 percent level, to 100 percent level, you'd have to increase the use of those resources fairly significantly; or use a fair amount of them.

But let's take a look now at how much it would take to fuel 100 million hydrogen vehicles, assuming they have somewhere between two and three times today's 20-mile per gallon average gasoline fuel economy. So these are vehicles in the 40- to 60-mile per gallon equivalent range.

And we see this band here. And this shows what the demand of hydrogen would be for that range. And referencing this now to the primary resources we see we're not going to make -- - incidentally, we won't make all the hydrogen from one thing, either. I think hydrogen, like electricity, will be regional in nature, make it from different locally available resources.

But what we see here is there are a number of different options here that could supply a fair amount of hydrogen. And over the next, say, 20 to 25 years, up to say 2025, 2030, most of these scenarios show that the amount of primary

energy you'd need wouldn't be terribly large to make hydrogen, I mean, as a fraction of what we use now.

So we could certainly learn whether or not this is going to work without unduly diverting other resources to finding that out for hydrogen.

And with the renewables, with wind and biomass we see that making hydrogen for about 100 million vehicles would involve somewhere like maybe 10 to 15, 20 percent of those resources to do that.

So, sometimes in the hydrogen debates you hear people say things like, if we make hydrogen from natural gas, it's going to triple our natural gas use. That's simply not the case.

Where will hydrogen come from? Probably in the near term, we make most of our hydrogen today from natural gas. We'll probably continue to do that for the next, you know, 10 or 20 years, a fair amount. You get some greenhouse gas reductions from that and it won't really increase natural gas use very much.

Beyond that timeframe we're going to be switching away from natural gas. The whole reason for hydrogen is going to zero carbon, zero

pollution. So we're going to be looking for renewable sources. In the long term there are a lot of resources for doing this. And there are many solutions for supply, as I said. It's going to be regional in nature, more like the electricity system and the current gasoline system, probably not going to have supply lines that are thousands of miles long, across water with a hydrogen economy. It's going to look a little more like what we do with the electric system, I think.

How much is all this going to cost? Well, there are estimates, and again there's quite a range. Somewhere between several hundred to several thousand dollars per vehicle for mature hydrogen refueling infrastructure. In the near term it'll be a good bit more than that. At least several thousand dollars per vehicle to build the refueling stations and production systems.

A study that was done for the hydrogen highway network, the first few stations are going to be even more than that. But in some sense, those are part of the demonstration process, I would say. And this is still a ways from commercialization.

Shell recently estimated you'd need about 11,000 hydrogen stations nationwide, and that would cost about $12 billion. Think about maybe about a million dollars a station. These would be stations along interstates and in major cities. Full implementation of hydrogen infrastructure might be hundreds of billions.

But, what's interesting is that the cost to maintain the conventional transportation fuel infrastructure is also quite large. There are estimates that have been made worldwide. Over the next 30 years the investments that are slated to be made in gasoline infrastructure, the production of it, exploration and all of the above, and those numbers are between a trillion and two trillion dollars.

So if you compare it to that, it may be that building hydrogen from scratch wouldn't be any more expensive than building a liquid fuel infrastructure. That sounds kind of crazy, but the reason that's so, with hydrogen you have a lot more of the distribution end. That's very expensive. The production end is actually a little less expensive; a little simpler than making a liquid fuel.

And you can use hydrogen a little more efficiently. So you build a plant of a certain size. You can actually serve more vehicles, more vehicle miles, than you can going through a liquid fuel route because of the conversion efficiency.

How much is it going to cost? Well, between $2 and $4 a kilogram. A kilogram of hydrogen has the same energy content as a gallon of gasoline. So, if we think about a mature infrastructure, $2.50 to $4 a gallon equivalent.

But if you have a car that's two to three times as efficient, you might come out with a cost per mile that's even a little bit less than what we're paying with our current 20-mile per gallon gasoline cars.

Just a couple of words about the current infrastructure. About 1 percent of our primary energy use and 5 percent of natural gas goes to make hydrogen today. Mostly for industrial settings like oil refining. If you took -- some of this hydrogen is shipped around in trucks and pipelines -- if you took all that capacity, now it serves technical and industrial users, but if you used that for cars, you'll have a distribution system that could serve about 1 percent of U.S.

cars today, with what we truck around and pipe around, with hydrogen. That's kind of amazing. So we already do have a hydrogen distribution system at the 1 percent scale level.

But here's where we need to go. The math I brought up there on the top left shows gasoline stations in the U.S. Okay. Each one of those dots is ten stations. Here the next competitor, CNG, is top right. And then we have, I think ethanol and methanol, which are shown below that.

If you plotted hydrogen on here I think you'd have maybe about 25 stations in the U.S., a lot of which are here in California. So we have a long way to go to build up this infrastructure.

How long is it going to take. Here is some historical data on penetration of transportation infrastructures. Talking about canals, rail, roads. And you typically have a time constant of about 30 to 70 years. So it takes while to build these things up.

It's interesting to look at the early days of the gasoline infrastructure. I think it was 1925 before you had as many cars as you had horses used for personal transportation in the

U.S. And all kinds of interesting sorts of stations were in the early days of gasoline. You'd send them with a bucket down to the corner grocery store; get a bucket of gasoline; take it home and, you know, slosh it into your car.

There were little mini gas stations with guys stationed along the roads. And you'd pull your car over right in the middle of traffic and they'd refuel you. Eventually it led to the development of refueling stations as a nice place to be, to get away from all that. And we had the system we have today.

With hydrogen, starting from a few cars, it will be interesting to see how that unfolds.

Here in California you've undoubtedly heard about the Governor's hydrogen highway network. And this is Governor Schwarzenegger announcing this program. This is at UC Davis. Actually he's fueling one of our experimental vehicles at the UC Davis hydrogen station right down the road. And he wanted to provide hydrogen to vehicles statewide by 2010. Renewable hydrogen production is encouraged as part of this.

There was a panel that was formed. I was one of 15 people on that. And then there were

teams of volunteers who contributed a lot of time in doing all the technical backup work around this idea. And this is now being synthesized into a report that should be delivered to the Governor pretty soon, I believe.

The idea here -- here's a simulation that was done. This shows southern California. The red dots there are planned or existing hydrogen stations that already exist or will be built soon in southern California. Some of these have been built with the collaboration with the DOE; some with the South Coast Air Quality Management District.

And the black dots there shown are CNG sites; they're fleet sites. And they might be an interesting place, also, to refuel hydrogen. You know, initially going with fleet vehicles is probably going to be what we'll see a lot of in the beginning.

So, this shows what's planned. And in planning this hydrogen highway idea, we looked at several different levels of implementation. And one of them was just sort of starting with what's planned and building out just a little bit.

We also looked at some other options

here. This would be about 200 stations in the L.A. area. And we looked at a couple of questions like how much would it cost to do this versus this. And what would be the travel time for people in the L.A. area.

If you only had about 40 stations here, you'd say, well, how long is it going to take people to drive to those. Is that going to be okay. If they're in fleet sites, maybe it won't matter. But one of the goals of this was to provide hydrogen to users.

So we did some calculations. This is some work one of our grad students, Mike Nicholas, did on this, looking at the drive time on average in the L.A. area for different scenarios. And if we start with 40 stations here, that's the first red circle, we see the drive time is something like ten minutes. That's about 1 percent of the gasoline stations in the L.A. area.

If you go to about 3 percent it goes down to five minutes. And if you follow this curve out all the way to 3000, which is where we are with gasoline, you'd find about two minutes.

So, even with the relatively small number of stations, though, it might be adequate

for an early adopter's convenience.

Hydrogen from biomass; let's get the biomass tied in. One of our grad students looked up in a report, estimated about 43 million dry tonnes of biomass every year from various sources. Just did a quick calculation, looking at gassifying that biomass at 60 percent energy conversion efficiency to make hydrogen, we found that for each tonne of biomass you could make about 80 kilograms of hydrogen. That's equivalent to about 80 gallons of gasoline on an energy basis.

If you then took a fuel cell car; assume it's two and a half times the current 20-mile per gallon efficiency on average; send it 10,000 miles a year. About 200 kilograms a year. And you could find 1 million tonnes would be about 400,000 cars. So that's a sizeable number.

And if you wanted to, say California's got roughly 25 million, if you wanted to do hydrogen for 20 percent of those, it would be about 12, a little over 12 million tonnes of biomass a year.

So, this shows that going this route you could, with some fraction of what's available, you

could make a fairly major impact on transportation markets.

One interesting thing with hydrogen is the well-to-wheels efficiency is a little more efficient. So, per tonne of biomass you can actually serve more vehicle miles that way, than with some of the liquid routes.

Okay, how soon could hydrogen make a difference. I'm going to finish, I've just got one or two more slides. Time to change the energy system is pretty long time, decades. Technologies need more development. Probably going to be several decades before you could start to reduce emissions in oil use on a really large scale.

But beyond 2025 a lot of people see a lot of potential for these technologies. And also there's this potential for new ways of using and making energy.

So, I'll just stop there. Thanks.

(Applause.)

MODERATOR VON BERNATH: Want to keep the questions to the last to all the members, okay?

The next person talking is Neil Koehler. I hope I'm saying correctly last name. Neil Koehler is Chairman and CEO of Pacific Ethanol

(indiscernible), a marketing company (indiscernible) California.

Neil Koehler is leading the company's effort to build the first world class ethanol plant in California. Mr. Koehler is an active participant on national ethanol issues and Kynergy is a member of the Renewable Fuels Association.

Mr. Koehler is Director of the California Renewable Fuels (indiscernible), a coalition of (indiscernible), environment, local (indiscernible) ethanol interests (indiscernible) for the betterment of California ethanol production industries.

MR. KOEHLER: Thank you very much. So the subject I was asked to speak on was the future of ethanol, both technology and resources. And I've titled it the future is now.

And on a personal note I want to say that, because myself and a few other people in this room, probably 20 years ago said, you know, we have this great opportunity to produce ethanol and develop renewable fuels and build a very vibrant industry, and develop new technologies, and in 15 to 20 years we can make it happen. So if the future is not now, then I should never be

invited back to speak in one of these events, because I was totally wrong. But I think the future is now and there's a lot of developments on the ground, in the policy world, and it's happening today in California that really does say very convincingly that the future is now. Challenges ahead, there are needs, but let's get going.

So, in terms of the opportunity to use ethanol in California, we have a lot of situations, some would call even crises, as it relates to the supply of transportation fuels in California. And ethanol now can make some very significant contributions in this regard.

Probably nothing more important that the issue of supply. We are growing, the use of transportation fuels in California at 2 to 3 percent per year. And we will never build another gasoline refinery in the state. Already importing 25 percent of our finished gasoline and components.

So, this situation is getting worse. It's getting critical. We all know it from the volatility of gas prices. And as time goes on this problem will become more severe.

The opportunity to today, through the Clean Air Act initiatives, we have 6 percent ethanol in every gallon of gas. That has made a contribution. But we lost 11 percent MTBE by way of the MTBE phase-out. So, we lost some volume in that transition. And the opportunity to add 10 percent ethanol in gasoline is the opportunity that is now, and the future is now to do that. It's what the rest of the United States, when ethanol is added, it's at its most optimal efficient level, which is 10 percent. Can help reduce gasoline prices by making this immediate contribution to supply.

Jobs. We have an opportunity to build an industry in this state. We are beginning to build an industry in this state that can provide a very valuable and extremely large source of jobs, estimated at 7000 new jobs, both direct and indirect, as we build out the industry to meet the ethanol demand in California. And $600 million of capital investment.

I think it would be very difficult to point to any other industrial development opportunity that we have in front of us today that could provide this kind of economic development

opportunity.

Climate change. Arguably the largest environmental issue that we face moving forward. And the Pew Institute last year concluded a study that did conclude that the most efficient and effective way to reduce CO2 emissions from the transportation sector was for the substitution of biofuels for hydrocarbon fuels. Ethanol 10 percent in blends in California can make an immediate reduction of 5.4 million tons a year of CO2 today. There really, again, is no other opportunity to provide that kind of immediate benefit on this large issue.

This is a slide from the California Energy Commission. They've taken this issue of petroleum dependence and supply very seriously. And in their report on petroleum dependence, this was a slide that kind of says it all in terms of the demand for transportation fuels, and the supply. The rather anemic red line on the bottom is the production of gasoline expected from the refining industry. And obviously you can see the growing gap between supply and demand.

It's really the future is now because in the past this really wasn't an issue. Go back to

2000 and before, we actually produced a surplus amount of gasoline from the refineries in California, shipped it out to other areas. We now are short finished product and import it into the state.

The ethanol can help fill in this gap. It is the world's fastest growing transportation fuel. This is looking at it on a U.S. production basis. And we've seen a very dramatic growth from the early '90s when we saw some of the first initiatives to support ethanol through tax incentives to where we are today. And if you look at the growth from 2000, 2001 forward, it's been exponential, very dramatic, driven largely by the replacement of MTBE on the east and west coasts. But more and more it's being used as an incremental source of supply and octane.

But we've seen some very dramatic growth; 3.4 billion gallons in 2004. Sounds like a very big number. It is. But when you consider that we use 140 billion gallons of gasoline annually in the United States, there's still a lot of growth to be had.

Putting it in the context of the economics of gas pricing and prices, this is a

chart that is off of the California Energy Commission's website that has tracked over the last couple of years the prices of ethanol, net its tax incentive, and the component prices of CARBOB, which is the gasoline to which ethanol is added. And then alkylate, which is another hydrocarbon product that provides some of the similar benefits that ethanol does in terms of octane and clean volume.

And as you can see very dramatically from this chart, ethanol has been significantly cheaper than gasoline throughout this entire period. At one point here when we had a drop in gas prices, where they converged a couple -- when ethanol was first introduced there at the beginning of the chart, there was a small time where it was above the price of gasoline.

But as the market has stabilized and ethanol has successfully made this transition, we have seen very positive economics. And as you can see, just in the last month or two, and this chart, if it were updated over the last two weeks, would show something even more dramatic, which is we have wholesale gasoline prices at $1.60; we have wholesale ethanol prices at under $1 today.

And so it is 60 to 70 cents cheaper than gasoline.

One would apply some economic theories and say, well, substitution theory, you know, these are all components that go together. When you have this kind of price signal you'd expect more of it to be used in the marketplace. And that's the dilemma that this chart is underlying, is that we have this price signal in the marketplace; we do not have more ethanol being used in California up to the 10 percent levels.

And that has to do with both some regulatory constraints that as we adjust to the new world of ethanol as a transportation fuel in California, there's a certain optimization that we need to see.

Also, it's an issue, not faulting the good customers of our industry and the oil industry, but they clearly have a different way of looking at the economics. In that they produce gasoline from crude oil. To ask oil companies to, on a voluntary basis, use more ethanol, even when it's obviously in the best interests of the consumer, is not always in the best interests of the oil industry. And this is really the role for public policy.

I have had major oil companies, in really no uncertain terms, go as far as telling me, you know, you couldn't pay me to use your ethanol in markets where I don't have to, because there's no way that you can compete with $25 a barrel price. A rather crass statement, but again I wouldn't fault these guys for having the business model they do. It's just that we need to look beyond that and consider where we need to, as policymakers, say we need to look at this in a different way.

A little national background on the industry. You know, clearly the growth has been in the midwest where the corn is. We are moving rapidly with technology to other feedstocks. But this today is a grain ethanol industry that has built around the midwest.

Dramatic growth, as we talked about. Eighty-three plants. Very decentralized. That's a lot of plants. A lot players in the industry. A very competitive industry. Sixteen plants under construction. So we're growing the industry so quickly; need to find new markets; and that's a good thing for California.

What's interesting about this chart is

that's where the production is, but if you go back to that chart that had the dramatic increase in production, I mean in the production, but driven by markets, all of the market development has really been on the east and west coast. And that really underlines the opportunity we have in California to try to match some production to where the market is.

Just some fun facts on the global perspective before we turn back to California. Ten billion gallons approximately of ethanol produced in the world in 2004. And with the United States being close to four, you can see we have a pretty good segment of that market.

Brazil actually produces over 4 billion gallons. So between Brazil and the United States you have close to 80 percent of all the fuel ethanol produced in the world.

That is changing dramatically. We are seeing anywhere where there is the opportunity to bring the raw materials to bear, we are seeing countries throughout the world develop ethanol and other biofuels programs to increase the production. So we're seeing large developments in Asia, in Africa. China actually has recently

built the largest ethanol plant in the world. So they've moved very dramatically in the direction of ethanol, as well.

The California market. Even more dramatic growth. From before 2001 when there was MTBE, there was virtually no ethanol use in California. Since the transition away from MTBE we've seen this growth from 125 million gallons in 2001 to the close to 1 billion gallons in 2004. So California has the very good opportunity, as it relates to building production, of commanding what is close to 30 percent of all the ethanol used in the United States. And almost 10 percent of all the ethanol used in the world, right here in California.

And it's all about to be able to produce ethanol in California there's technology issues. We can talk about that. As it relates to the existing commercially proven technology, that's grain to ethanol, and the only way that you can build ethanol plants to be cost competitive with the midwest is to have local markets for all the products, the ethanol and the distillers grain, which is left over.

California has the very distinct

position of being really the intersection of the world's largest fuel and feed markets. We've talked about the large gasoline market, the large ethanol market. Also unknown to a lot of folks is that the Central Valley of California is home to the world's largest dairy shed. And feeding the byproduct left over from corn ethanol production to dairy cows is the highest value use of that product. We have 1.5 million head of dairy cow between Sacramento and Bakersfield. A very significant number that provides the opportunity to not only produce the ethanol for the local market, but the distillers grain.

The future definitely is now in regards to this development. We have three permitted sites in California. One plant in Goshen is currently under construction of a 25 million gallon per year ethanol facility. Our company, Pacific Ethanol, is scheduled to break ground hopefully in the next two months in a plant in Madera, which will be a 35 million gallon per year facility. And the third is a plant in Pixley being developed by a company called CalGrain, that will be in excess of 40 million gallons per year. All corn ethanol; all fully integrating into

the local dairy shed in the Central Valley.

One aspect of a number of these plants, and certainly in our case, is the opportunity to incorporate cellulose ethanol. We really feel that the grain ethanol is the platform for developing what really is the holy grail for ethanol and the significant production opportunity in California, and that is converting cellulose of all forms, waste, and ultimately primary raw materials to ethanol.

And that the corn ethanol industry that we're building here in California can become a platform for that development. And we see that as very significant in moving the technology challenges forward.

And because of that we do believe there's a very bright future for cellulose. You have certainly John Ferrell talked about it this morning. I'm not going to go into detail in the technologies, but we have three very viable pathways; all three are being developed; all three have commercial opportunities mixed with different feedstocks, mixed with different regions.

And so I think we'll see a diversity of technologies which is just good for moving the

opportunities forward, creating competition and increased feedstock compatibility.

Obviously California has a wide range of raw materials that can be used. Rice, straw, cotton gin trash, orchard prunings, mixed waste papers to mention just a few, forest thinnings. And the list goes on. And it's really the waste products that are the low-hanging fruit that are significant waste disposal problems in California. And the opportunity to use those products for conversion into ethanol is excellent.

Barriers. I mean we've talked a bit about barriers already today. Clearly there's a higher cost element, and technology risks, market uncertainty, lack of coherent government policies.

The higher cost technology risk, those are things that just need to be developed through the research and development process. The market issues I'll touch on in a moment.

To put the cost issue is just using the enzyme example of the significant progress that has been made since 1999, you can see, and it's really in the lowering the cost of the enzyme. John Ferrell referring to that, as well.

So we have a situation where if you

compare starch, which is the competitive source of ethanol, with cellulose, we've come a long way since 1999. We have further to go before this technology is cost effective.

The market future is now because there are the opportunities we've talked about. The issues are real, and they require some coordinated and coherent public policy response.

Talked about the 10 percent ethanol blends being an immediate opportunity for incremental supply. We have this opportunity with flex-fuel vehicles. There's 400,000 of them in California today, yet they're not running on ethanol.

But the opportunity is to do it, to create an opportunity such as Brazil where the amount of ethanol in the gasoline just grows from 20 percent all the way to 100 percent. You can get all varieties at different levels at all the gas stations throughout Brazil, creating this incredible diverse and flexible system that can be resilient with the economic moves up and down in commodity prices, et cetera.

Ethanol's a renewable source of hydrogen. It's a -- there are three hydrogen

molecules, atoms in the ethanol molecule, so a very rich source of hydrogen. And ethanol being used in biodiesel production. So lots of synergies between the renewable fuels.

What does the market need to really recognize these opportunities. I always like to say conservation because given the incredible amount of liquid fuels we use, there is no alternative to gasoline that's going to make a meaningful dent unless we actually conserve. And that's fuel efficiency standards, first and foremost, not an issue that California controls, but one that we as a nation, as a world, are going to have to address.

Once we've tried to put a dent in the demand, then what we really need is an open competition for fuels. And this is really kind of the paradigm that I think we, as citizens and public policymakers, really need to get our arms around, is that we do not have open competition.

People like to say let the market decide. Well, back to my comments about the market is the oil companies controlling the supply of gasoline production and distribution in California. They are not open to competition.

There needs to be policies put in place that encourage a truly open competition for the fuel tank on our cars, which we don't have today.

The diversification of supply is good for the market. Fungibility is the way to help encourage competition by allowing these fuels to be blended together and used.

It's very down to the nut of it in terms of what policy we need to move this industry to the next level. California RFG is now going through a process over the next year. I think Dean might talk about it in his comments. And really applaud the efforts to look at the new data out there, the new realities, the economics. And to try to build a reformulated gasoline regulation that is optimized for 10 percent ethanol. That is the best interest of the State of California, best interests of the environment, best interests of the economy.

And there are issues that have to be worked through on that, that can all be done. And if we set as our goal that we are going to do this optimization we will be better served.

The way to deal with open competition is set performance standards. There's talk about a

federal renewable fuel standard. We haven't seen it happen. California has to take its destiny into its own hands, just as we've done on electricity where we have a renewable portfolio standard for electricity, we should have a renewable portfolio standard for fuels. It is the most sensible public policy and would do the most to develop this industry in California and take away the market risk and uncertainty that has truly challenged the development of this industry.

Require that every new vehicle sold in California be flexible fuel. That would provide the opportunity and the fungibility to, as ethanol is brought online, we can move the mix up to 20 percent, 30 percent, whatever the opportunity might be as we move out into 2050 and beyond.

And to really work with the federal government, John Ferrell and his programs; to site these demonstration plants here in California. There's huge capital risks, there's huge cost barriers; it's going to be a public/private partnership to get these facilities built the first round, certainly.

And with that, I will conclude my remarks.

(Applause.)

MODERATOR VON BERNATH: Okay, the next speaker is going to divide his presentation in two parts, one done by Gary Yowell -- hopefully say it correctly. He's work with the California Energy Commission in the transportation fuels office. And in this (indiscernible) analyze and interpret data provided by the petroleum industries and the Office (indiscernible) Renewable and Alternative Fuels.

He's leading the analysis for biodiesels, biomass to (indiscernible) and light duties and diesel (indiscernible) for the Commission's 2005 Integrated Energy Policy Report due out this summer.

The other person that will talk in the half part is Brian Appel. He's the Chairman and Chief Executive Officer for Changing The World Technologies, a company responsible for successfully bringing emerging environmentally friendly technologies to the international marketplace.

Mr. Appel found a changing world technology in 1997, and in 1999 he started (indiscernible) research and development facility

in Philadelphia where (indiscernible) process that is undeveloped.

So, Mr. Yowell, do you want to come.

MR. YOWELL: Tell you what, since I work for the Energy Commission, I'm going to use the Energy Commission presentation. If you'll hold on for one second. I think I got it now.

Okay, here I am. I have ten minutes to go through 22 slides, so please bear with me. I'll be talking about the first four items here on this outline and I'll leave the fifth item for my co-speaker, Brian Appel.

First, a little backward view of what's happening in California. California's evolved from a state that's been pretty much self sufficient in domestic sources of crude oil in 1988, and as it evolved to a state that's going to become more and more dependent on foreign sources. And we view that at the Commission as a potential liability and risk that we want to help mitigate and minimize that future event.

Where are we going? If we ask the oil companies where we're headed for, they'll say, well, this is pretty much the future that they see. This is one from Shell. Shows predominately

a gasoline and diesel future with very small sliver of alternative gaseous fuels at the top and lower end of the spectrum, as we would expect.

And if we were to ask a vehicle manufacturer, say Volkswagen in this case, what they would view, and this is their scenario for Europe, but I think it has applicability to California, as well. We see there a predominately crude-base oil future with a synthesis fuel of gas-to-liquids, and biomass-based fuels. Again, with slivers of hydrogen and alternative fuels down at the bottom.

You ask the Energy Commission and we have a different view about the problems, and I'd like to ditto what Neil Koehler mentioned already. And like to add the fact of well, what the oil companies are telling us is the gaps there, yeah, don't worry about it, we've had that gap for many years, in fact. And they can continue to fill the gap with additional finished and semi-finished products. And they have, and they will, and they'll continue. The question is will they continue that through 3 billion and 9 billion gallon shortfall, as we project here.

And perhaps we, as a state, should take

incremental steps to mitigate that. And we can mitigate that through higher efficiency vehicles, and with alternative fuels. And that's why I'm here today.

The vehicle manufacturers have had three decades working on reducing vehicle emissions. And they're now at a point of 95 to 99 percent emission reductions. And here's Volkswagen's view, showing that they're now evolving into concerns of CO2 emissions and looking at more sustainable fuel sources for their sustainability of their industry.

To their credit Volkswagen has joined with Shell Global Solutions, and has developed a shared fuel strategy, which has a fuel strategy of fuel evolution, moving from the crude-base oils of today through synthetic fuels and renewable fuels and whatnot.

Which leads me to one of the conclusions I have observed over the last 15 years working with alternative fuels. Some of the prerequisites for a sustainable transportation fuels. And the fundamental point is that a sustainable fuel needs to be a liquid at room temperature and pressured to be competitive. And it has to be compatible

with existing petroleum infrastructure and petroleum-based vehicles. And, of course, ultimately has to be economically competitive at some point in the game.

On the diesel side of renewable fuels I'm glad to say that all five of these fuels do meet at least the top three criteria, with special mention to the top three of the gas-to-liquid, coal-to-liquid and biomass-to-liquid fuels. These are very powerful future energy sources. They all use the Fischer Tropsch reaction process to produce a very high quality diesel fuel that has gotten the attention of Volkswagen and Daimler Chrysler, with the possible exception of the biomass has -- well, all three fuels use the same process. They only differ by the feed source used to make the product.

And the biomass-to-liquid process is the one that Volkswagen is very impressed with because that enables the vehicle to compete on a CO2 and a resource sustainability level.

I also have the thermal conversion process here as a very new fuel process that I think will give a strong competition to the biomass-to-liquid fuels. And we'll have more

discussions on that later. As well as we have the biodiesel, a very small but important contribution that can be made with that fuel, as well.

I just want to talk about the 300-pound gorilla here. It's GTL. Now, all the major oil companies are in the process of developing this commercial scale applications. The process is merely taking remote natural gas resources that are too far away to economically be competitive in a market, and were brought to a pipeline. They run the Fischer Tropsch synthesis, and then they produce about a 70 percent diesel and a 30 percent naphtha blend.

California's been using this fuel on an intermittent basis since 1993 from various refineries on a time-to-time basis. And now they're ready for large-scale applications. And by that I mean there's over $20 billion committed to additional new plants in most of the country of Qatar. And these are the volumes that we've estimated that will be available in this timeframe.

In 2015, California is likely to be consuming around 4.2 billion gallons of diesel, so this shows you the volume in relative context to

California demand. Not that it would all come to California, of course.

But the important thing about GTL is that it enables or perfects the science and lowers the cost that would enable the biomass-to-liquid concept to move forward.

And here's Volkswagen's rendition of the CO2 cycle with their biomass fuels. And, again, biomass-to-liquid using the Fischer Tropsch reaction process, and starting with the biomass fuel. It's a great process; looks very promising.

I borrowed this from Volkswagen, as well. This is one view of a vehicle manufacturer's perspective. And I think it's reasonable and it's consistent with what I've observed over the years working with the alternative fuels.

I just want to look at three fuels here that are relevant to today's topic. One is the biogas. Here it shows their position of the viability of this fuel as not a practical future purpose use for fuel. I think that's important from their perspective and from our perspective how gaseous fuels have a very difficult time competing in the market.

But more importantly I'd like to look at the BTL diesel and the biodiesel here. This is the biodiesel from the ester column. And here their position of biodiesel under BTL being up to 100 percent compatible as a petroleum displacement fuel; and I definitely support that, as well as the biodiesel as a 5 percent solution. I can definitely see that, as well.

And, of course, you've all heard about biodiesel as a very clean fuel, and it is. And it has these emission reductions with the possible exception of the NOx, a slight increase of 10 percent at the higher levels.

I think it's interesting to compare this to the GTLs or the BTL fuels which will have similar emissions reductions except the NOx emission reduction instead of being 10 percent increase would be about a 10 or 15 percent decrease depending on what part of the world fuel you're using.

Now, how important is that? Well, here's something again from Volkswagen showing how a fleet of diesel vehicles operating on convention diesel fuel, merely by switching to a GTL fuel, this is a Shell middle distillate fuel, but it's a

GTL fuel nonetheless, how they would lower emissions, come into an emission compliance level Euro-4 and reduce the variability of the emission levels. And I think it's a very powerful inducement for the vehicle manufacturers who are aggressively pursuing NOx reductions and particulate controls down to very low low levels, 95 percent reductions.

I've been tracking the California fleet's use of various alternative fuels and determined an incremental cost effectiveness for the various fuels. With the exception of biomass-to-liquid I've just thrown that in as an average reading of various reports on the cost of this fuel.

Of course, the low cost leader is propane at 22 cents a gallon. This is 22 cents a gallon over the prevailing price of diesel. So if diesel's at $2, it would cost you $2.22 to use propane per gallon of avoided diesel fuel.

Conversely, for CNG or LNG we're essentially paying $2.25 plus $2, so about $4.25 on the high side to reduce a gallon of diesel fuel with the use of CNG.

Now, clearly the alternative fuels in

the liquid genre have fairly low costs. And that's something that we don't really work with very closely. The consumer looks at the higher cost of the fuel and says, oh, it's noncompetitive.

But when we put them in context of what we're spending already on other hardware-dominated technologies like the CNG or hydrogen or propane, propane being the exception, you know, it puts things in better perspective.

Now, these are affordable fuels, even at a higher price. And when we're trying to avoid a 3- to 10-billion gallon shortfall in fuel supply, the cost effectiveness becomes very important.

Here's a corn facility. I have three or four things to say about it. One, it's a pilot facility; it's working out some bugs; it's expensive fuel at the time; and needs more work and more development. And that's why I have the Changing World Technology folks here to talk about their process, which has a similar feed source, could have a similar feed source, and a conventional crude product. But it is another way of using biomass and bringing out to a diesel fuel.

What's industry telling me? I'm hearing from various sources that the prerequisites for a biodiesel or a renewable diesel fuel penetration is that it needs to be mandated or legislated for use, or incentives would need to be applied to pay for the incremental fuel cost. And these are necessary to get the economies of scale so that these fuels can compete or work within the petroleum-dominated fuel supply and markets.

And I just love Volkswagen's hardware. I had to have a hardware here to show you guys. You know, we're attacking the problem on the fuel end for today's conferences, but, you know, we're also looking at other options, too. And there's high efficiency vehicles. I believe this car gets 237 miles per gallon, and I think that goes a long way. And so there is competition to ways to reduce petroleum use and to reduce CO2 from the vehicle side and from the fuel side. And they can also be married together and give them very significant results.

With that I'd like to end and allow Brian Appel to take his position here.

(Applause.)

MR. APPEL: Thank you, everybody. I

guess I got the other ten minutes, so I'm going to go fast.

We're the company that has been purported to turn anything into diesel. We were featured in Discover Magazine, Scientific American Top 50, Money Magazine, you name it. We've been on a bunch of shows. We've been featured in Rocky Mountain Institute's winning the oil end game as a prominent transitional fuel to get towards where we were going when we talked about the hydrogen economy.

There was just a new report that was put out called Ending the Energy Stalemate, which was a report that was issued in Washington where we were prominently featured as the most promising biodiesel to be able to supplement the dwindling supplies of oil.

We've been through environmental assessments, two of them. We've been through new source reviews. We've been through life cycle analysis at both MIT, and just completed one that was presented in Detroit with the Big Three Auto through the vehicle recycling partnership that showed tremendous promise.

We also have been through the Stagegate

review process, and I have to mention that because ConAgra Foods is my partner and they weren't mentioned in the last presentation. And we were one of the first companies to go through that Stagegate review. And there's a lot to learn about that.

Let me see if I can fix this. How we do this is we have a thermal conversion process that basically every company or municipality produces waste low-value streams. And from that waste low-value streams we convert that material, using this thermal conversion process, into oil, gas and a solid.

The process is relatively simple and straightforward. We prepare the feedstock; we pressurize it, heat it, go up to about 250 degrees C, 600 pounds of pressure so all the pathological vectors are destroyed including mutated proteins like prions, which are causing havoc in the food chain and breaking down dioxins.

We then separate the organics from the inorganics and the water. And then we further crack the, it's like a number 4 oil into a gasoline diesel weight fuel.

The market opportunities are

significant. The three low-lying fruits where we have projects actually going on is one is with ConAgra Foods; it's a $20 billion food company in the food business. You know them for your refrigerator basically; brands like Armor, Swift, Hebrew National, Butterball.

The agricultural waste represents 51 percent of the 12 billion tons produced each and every year in the United States.

The auto and rubber industry, we've been working with the vehicle recycling partnership and Goodyear Tires to convert that material.

And then municipal sewage sludge with the City of Philadelphia; and most recently with the City of Ottawa.

When we look at California energy conversion we heard this morning that the Department of Energy estimated 30 percent of our energy needs can come from biomass. Let's break that down further. In California, if we were to just take from the California 1999 statewide waste composition study, just the paper, plastics, organics and tires we can make 6 million gallons of gasoline diesel weight every day. That's a significant contribution to the state's needs.

I normally wouldn't put this comparison of available technologies on diverting the solids away from landfill, but I was a bit surprised to get from the Integrated Waste Management Board a report that encouraged pyrolysis, incineration and digesters as the only option. And I think it's a very limited approach. If we're going to make meaningful strides in reducing the landfill approach we have to have new technologies. But if we start to incinerate and gassify, just use digesters, there's going to be issues if we don't open it up and level the playing field to other technologies.

There's multiple sources available. This particular feedstock does not even make the characterization of waste because it's actually considered animal feed. But agricultural waste produces fats, bones, feathers, offal sludges from the processing of making food.

If you take that material right now in the United States you're still allowed to put it back into animal feed. There's regulations are going to come down that are going to stop that, like in Europe and Canada just proposed as specified risk material. There's going to be a

real need to take this material and put it somewhere else other than back into feed and food. But all that can be converted into oil.

This is our plant in Carthage, Missouri; at a Butterball turkey facility. We utilize existing infrastructure. That means you can get to the market real quickly at both the front end and the back end. You want to integrate right into the facility so you don't want to interrupt what the co-activity of that company is doing. And then, of course, we make oil and that can slide into the petroleum distribution system.

The plant is over 80 percent energy efficient. We have that backed up by all these lifecycle analysis and the Stagegate review from the Department of Energy and MIT. We use water under pressure. We do not evaporate the water. That's really important for people that need water, so agricultural and industrial grade water applications. So this plant discharges 30,000 gallons of water that's been sterilized and you can use for irrigation. It has some amino acids and phenols and things like that that are good for plants.

There's no incineration or combustion,

avoiding bad actors. Today we are putting chlorine and bromine and all these things to make our potable water cleaner. We got solvents, we got all sorts of bad things going in there. So if we combust anything with that oxygen and chlorine compound we're going to make dioxins and fluorines and that's going to complicate our lives. We do not do that. Nothing hits an open flame except for the gas that comes off the process.

So we're processing right now 250 tons of waste that's about 50 percent water, and the rest are inorganics and organic material.

The formal conversion process products, we try to meet a commercial specification. We actually do on the oil and we just finished our testing on the fertilizer. We shoot for a D-975 and D-396 specification because engine manufacturers already guarantee the performance and quality of that engine when you use fuels that meet that specification.

That also eliminates special handling required so you don't have to have two tanks and all these, you know, strange mixing tanks.

The material basically goes in, if you start from right to left. It's the fats, the

bones, the feathers, the sludge without any separation. And then we cook that material. We make like a number 4 oil. And go right into any boiler, any engine. We're running that in Carthage; we're an electric -- making electricity right on the grid right now.

And the white Petrie dishes, basically your PTO-5 and your calcium -- bones. The lighter colored one where it says the diesel split, that's a gasoline diesel split. Then you can further fractionate that. And that goes right into an engine. We run it right into spark -- engines, not just compression engine, after you fractionate that.

If you look at sewer sludge, it's also coordinated with our (inaudible) application of that soon, because we stopped ocean dumping, so we're going to have to figure out somewhere else other than animal feed where to put this.

We're not going to complicate a sewage treatment plant's integration. All we're going to do is just replace the digester. So, off your primary clarifiers, your secondary clarifiers, you concentrate that material; then you begin the process to make renewable energy. We completed a

test with the City of Philadelphia on that, and it's very exciting.

How can we make oil out of this material? Let's take a typical label. Does it matter if it's an animal, if it's a pig, a cattle, or in this case turkeys. If you look at the back of the label, you identify fats, carbohydrates and proteins. And we're trying to make hydrocarbons.

If we look at methane, that's our natural gas, and that could be a choice of fuels for California Energy Commission and everybody else using natural gas.

But octane, for that word that's basically the measurement of gasoline. It's eight carbons long. And then if we look at the measurement for diesel it's not a big range. We look at cetane. And how can we make that out of agricultural waste and organic waste? Well, if we take a look at fatty acids, (inaudible) acid, side by side next to cetane, it's very similar except it has a carboxylic group on the end. We crack that off and make cetane, your middle-range diesel fuel.

If I look at proteins, they're just strings of these amino acids, so they have the

same carboxylic group, carb and hydrogen. Except they have an amine group. We want to go after that amine group, and because one of the products is fertilizer. We just concluded our tests with Auburn University that our fertilizer substantially increases the growth of both roots and the plants in cucumbers, tomatoes, peppers and all the other stuff they put us through to make sure that the product that we were going to sell could be used on fertilizer.

The last thing is carbohydrates. If I look at the blood sugar going through bodies, it's basically C6H12O6. O6 carbon is not shown here. And then the table sugar you might have had in your coffee or your tea this morning, they're just links of those glucose connected with oxygen. You can see that you can break those down relatively easy. If you look at plants they're just links of these sugar molecules.

Plastics is even easier because we know it came from petroleum, so to turn that back into oil is relatively simple. We have a multiple step environment. So the first things that break are oxygen and chlorine bonds. And that includes dioxins and PVCs. And then the second stage we

break our carbon-carbon bonds; those are a little tougher bonds to break.

But if you look at the little box, it says vehicle recycling partnership. We've taken all that nasty material after they recovered the metals and the glass, and that includes 5 percent PVC. There's no separation required because we're not incinerating anything. We're not going to make any nasty byproducts like dioxins and furans. All those chlorinated compounds, chlorine loves water. Our process uses water. And through the hydrolysis process all that chlorine is safety disposed of.

When you look at biomass oil produced and potentially utilized in California we say where can that oil go. Basically the market is in two big categories. One is fixed energy. We like going after the fixed energy market, cleaning up these fuels because these people are usually grandfathered in with permits to be able to do things that we wouldn't want to do today under new source review. And then, of course, the transportation fuel markets. These are enormous markets.

The petroleum industry, and we're

looking at potentially say that they're not players. I think they can be huge players. It's a very complex involved developed supply chain. You have crude, you have gatherers, you have refineries. We call the refineries the guard dogs. We think the guard dogs are really important in this equation because they're going to guarantee the performance in the engine.

When you want to start your car, okay, whether it's a military operation, a NATO operation, or just going to the soccer field, you want to make sure that your car starts and you want an engine performance guarantee.

And then we look at fuel blenders because of all these boutique fuels because of air emissions. And then, of course, end users, and they could be both.

If we look at what government has done, and there's a lot of government officials here, the governments have -- the proposition for fixed energy, both policies requiring and restricting use. And then, of course, subsidies. We have to look at what we're doing. We're not the biodiesel the methyl ester; we're a different biodiesel, we're bond (inaudible) hydrocarbon -- I'm going

fast because I see I'm getting flagged.

The alternative supply, there's a number of nonsubsidy programs been enacted. If we look at executive order 13149 mandating this petroleum reduction; we look what Minnesota just did for 2 percent requirement of biodiesel in the fuel oils. It's going to drive demand. And we got state RFS standards.

We have to look at the next steps which is identify the driving force on how to get into the market, and there will be a copy of this slide, so I'm going to skip right through and get to the last one for my closing remarks.

There's been a desire, whether it's EPAC or other mandated programs, to reduce our dependence on foreign sources of oil and petroleum. We need to work together; we need to embrace the petroleum market, the power markets. Biodiesel is difficult to use, so let's help them find a way to deal with the glycerine, to find a way to deal with potential using that at refinery.

NATO, the U.S. Department of Defense, Defense Logistics Agency are trying to go to a single fuel, so that means that we need to minimize this complication of this boutique fuel

approach. That's not going to work if we're going to make meaningful amounts of oil.

This state is in a unique position because there are already federal subsidies out there, and you have one of the most powerful people to change that, the Chairman of the House Ways and Means Committee, by putting parity in the system and allowing all alternative fuels that are made from biomass an equal opportunity to be able to get the subsidy. You can make a difference.

The other thing I'd like to say is that whoever in the government is here, take a trip with us to see 200 tons of this material going in and going right to oil companies. Today we started shipping a refinery, and I don't believe there's a biofuel in the world that can ship a refinery. They do not want these biofuels because of the difficulty in making these methyl esters and all the other complications that we put with them.

The incentives that -- there's an energy bill being cut up right now. And there will be a transportation bill for June. This state should work very quickly so that it's not put at a disadvantage and doesn't have anything put down

their throats that it doesn't want, so that it works within the federal structures so that it can leverage all the things that are going on in Washington with these great goals of the state.

Thank you.

(Applause.)

MODERATOR VON BERNATH: The next speaker is Kim Kristoff. He's the Chairman and Cofounder of the Biobased Manufacturers Association, a national nonprofit association representing the biobased manufacturers in the United States -- promoting biobased products.

He is also President and Co-owner of GemTech Products in Phoenix, Arizona, one of the leading companies that manufactures and markets plant-based industrial cleaners, sorbents and lubricants that are (indiscernible) and readily biodegradable.

Kim Kristoff.

MR. KRISTOFF: Good morning. My special thanks to Neil Koehler because he stressed an issue that I certainly want to applaud. Some background so that the rest of what I have to say in a very few minutes is helpful.

Make no mistake, when you leave this

room, you're either for or you're against ethanol. And if you're in between, then you have a bigger problem than we're going to solve in this kind of environment.

Ethanol is the most exciting future we don't have right now. And I'll bet if I asked for a raise of hands, and I'm not, how many of you actually believe that we can solve America's energy problem with ethanol, fewer then 10 percent of you would actually believe that statement.

Earlier this morning I listened to John Ferrell point out the 33.3 percent of our fuel energy needs could be solved with current agrible land area. I was just ten years old in October of 1958 in Brazil where my CIA father and our five kids lived to watch a dictator decide one morning to take bagaz (phonetic) and change it into ethanol and force an entire country to acclimate to the notion of running their vehicles on ethanol.

Now, I don't know what that sounds like to you, but imagine one morning here in California somebody said the notion of gasoline is usual. Or diesel fuel is usual. Does not exist right now, today. Think about that.

How many of you have actually given any serious thought -- I mean, yes, you are here, but how many of you have given any serious thought to just what you would do, for you and your family and your kids. Not the guy down the street who you're going to beat out to the gas station and get the last drop. What would you do?

It's fascinating. I travel around the country to venues like this, and I serve on a number of FAC, federal advisory committees, and I work at various state levels, et cetera, trying to inform on the options available to each state. Each, of course, is competing with the State of California.

The recurring nightmare that I have, and I wake up sometimes driving my wife nuts at around 4:30 in the morning when an Indian usually is calling me because I handle the Asian continent for sales in my particular company, and I tell her the same thing. I can't believe that I worry about ethanol. I produce ethanol; not a lot of it. We produce biodiesel, and not a lot of that, either.

And yesterday, during the board hearing, I was listening to a couple of comments, and I

reminded myself who are they kidding. It is not possible today, as a reseller of these products, to make any money. You want to be there. You want your foot in the door, but you can't make any money at it.

Where is the opportunity in producing products in this kind of crazy-getting-started venue, either here in California, which matters more than any place else in America, or any other state? Say Iowa, where that particular land grant college, the best friend of the USDA now for 78 years, knows all there is to know about ethanol, but even that state is having a tough time getting people to get excited about ethanol. It still represents less than .3 of 1 percent in sales.

Take you backwards. A couple of years ago, just on a hunch, -- incidentally I have a combustion engineering background. I'm an architect and I'm also a cartoonist and illustrator.

And along the way I told people in my plant what I want to do is test. Oh, no, there won't be any federal or state money involved. In fact, that's the good news. And ATFE won't be involved. We're going to take our 2002 Suburban,

this is the big engine, the big guzzling engine, 5700-some-odd pounds of steel, and we're going to start running it on ethanol. And I don't mean any fancy E85, I mean 98.8 percent anhydrous ethanol from corn.

I was told immediately you won't last a month. Now, here two years later I know something, I'm not guessing, I actually know something about moving around a piece of machinery that heavy with ethanol. You can do it. It's a little bit of a problem, up in Flagstaff, Arizona at 7000 feet of elevation, starting it because there's just not enough fat in the ethanol to overcome the first minute or two, so it's a little shuddery.

But otherwise, in two years, I'm telling you, in flatland, that's Phoenix, Arizona, we haven't had a problem.

This last spring, now a year ago, we started running an Acura, '98 Acura, 2.5 TL on that same fuel. Incidentally, the fuel really does have almost 2 percent fat in it in the form of an ester of soy and bitrix for the ATFE's particular interest in denaturing.

But think about it. Yes, I realize it

was a risk. Is the average person going to do it? No. Would I go out and advertise that everyone else should? No.

But with a combustion background and race engineering of big and small blocks, and even bikes, I realized there's got to be more to this story. A high octane fuel that appears to be incredibly friendly is so hidden from public discussion. Why?

And that gets me to the abusive comment that I'm always blamed for after the fact when I meet my two brothers-in-law, one from Shell and one from Exxon, at Christmas and Easter. That's the Holy Wars -- where we talk about the eventual likelihood that those two very large corporations will take over the biobased community for breakfast one morning. And make all of us worthless.

If you believe, as I do, in this subject, of a reduction in our almost profane dependence on petroleum, you could start this morning, or start yesterday morning. Because I'm a fanatic, I'm a fanatic on finding independence from petroleum in my lifetime.

In his book, Bill Bryson, eloquent

piece, The Short History of Nearly Everything, I invite you to go out and find a copy, $16 in most book stores. Bill Bryson talks about the cause of change. And he did it much more eloquently than I can.

Change is the result of need, desire, threat and natural occurrence. But nothing causes change like force. And so I think about how we're mollycoddling the notion of changing to a biobased society. And here in California, where the most sensitive people about the environment supposedly live. Think about it.

With apologies to anybody that I'm embarrassing right now, it was only four years ago, and the notion of ethanol in this state as a primary fuel was impossible. Can you imagine it? Can you imagine that?

Preparing for this morning I talked to several friends at corporations, and I realized, well, I can't come and sell something specific here today. I can't sell a product. I'd love to talk about a number of great products in the State of California that are biobased.

But I thought I'd start with what is biobased, what does it mean? From biomass, I'm

embarrassed to find out that even very learned professionals still don't know what the term means. It certainly doesn't mean corn. And it certainly doesn't mean milk.

It certainly means that you're going to take a naturally occurring product, whether it's plant or animal, and you're going to refine it through some process, some mechanical process to change its naturally occurring configuration.

In my own company, a company called GemTech -- this is not an advertisement, but a little explanation -- we make a broad range of cleaners, solvents, lubricants and biofuels. We also make a number of specialty chemicals. And they're all roughly arranged around the notion of long chain linear alcohols. Some of them are athoxylated, some sulfonated, some of them are esterified, for instance soy, methyl ester.

And while we pride ourselves on taking a very nontoxic approach to the planet earth, in fact our mission is safely cleaning planet earth, that's the whole mission statement, what we find is that our world is mostly made up of fat.

Well, not coincidentally just about everything we're talking about one way or another

comes from either cellulosic or fat-based materials and plants. To a lesser degree from animals.

And we started thinking of things we could do with it. And our good friends at Cargill, Tate and Lyle, West Central Soy, Griffin, all fat producers, if you will, of one kind of another, just were right up our alley for producing various kinds of linear alcohol athoxylate based surfactant systems, free fatty acids that we sell into the secondary market, reacted alcohol with amines attached.

And we discovered that there were tremendous opportunities for us. But back in 1991 nobody wanted them. Nobody cared about them. We were at least 20 to 30 percent more than products that we competed with.

I'm thinking about California right now, when I realize the dozen or so big names that I can think of that seem to be doing better now. They're all the crawl on your belly like a snake phase that we started out in.

Because we spent the first 12 years of our life losing money at the speed of light. Try to imagine you don't go borrow this kind of money.

When you head off into a new venture after 1986 tax law changes, you have a bright new idea as an entrepreneur and you want to make money at it, here or otherwise, you don't go borrow money. You find investors who are willing to dig that hole with you.

Twelve years of losing money before we actually made good profits. And now, while it's true that most of my competitors and people who make similar kinds of products are beginning to see an upswing, very recently, just the last two years, it's tragic how much money all of them had to go into the hole for.

The kind of money that existed, the crazy money before 2000, in the marketplace for the dotcom fiasco doesn't exist for people starting out in our industry.

And so with Neil's comments about ethanol in your minds I thought we'd go forward here, Biobased Manufacturers Association, which I'm Chairman of, I'm also the founder of. Somebody put me to the threat, a guy named Mike Kossy, who I think Kay Martin knows, at the USDA, someone John Ferrell certainly knows very well, he put me to task.

He said, Kim, if you really believe in the biobased economy go out and start a trade association to market their products. It's the biggest problem they have. Finding a voice; finding representation in the marketplace. Not standing alone. Some of the largest ones, $100 million is a blink, and that's a very large biobased company.

What is biobased? What is it? A product that has 1 percent biobased material in it, that's not a biobased product. But there are plenty of manufacturers who make products that have some amount of content that is biobased sourced, plant or animal.

And so one of the things we had to figure out right away in the BMA is how to differentiate, just to create a special language we could all speak. For instance, just to help the media talk about it, what is biobased. And I'll bet when you leave this room you still don't know.

A panel that is the shroud of the front of a tractor John Deere made out of PLAs from Cargill, that's about 70 percent biobased, or if you will, plant- and animal-based material,

doesn't make a biobased tractor. It makes a biobased component. And so largely that's the marketplace that exists, and it's going to continue to exist for a long time as we transition away from petroleum.

Mission. The mission for the BMA: To promote excellence in the manufacture, sale and use of biobased products in the responsible development of renewable resources.

Simple. You would be amazed how few people give a damn. You would be amazed how few people have any idea how to put that to constructive use. Because the first thing on everyone's mind is turning a buck right now. I'm talking about marketing language right now. I'm a marketer. And it's true, I belong to a manufacturing company; have spent a lot of money trying to get it off the ground, et cetera. It's certainly why we started the BMA.

But I realize from a marketing point of view the enemy that we all have is trying to find friends that agree with us in high places. Because while everyone chatters about the biobased economy and biomass in general, the single focus that's almost monotony to me is about energy

conversion of one kind or another.

Practically speaking, there's no money in it for the producers. Ask any of them, including the couple that are in this room. It's hard to make your zillion dollars in fuel because it's competing against a standard that's so heavily subsidized -- and here starts my rant on petroleum for a minute -- it's so heavily subsidized that we don't mind throwing away -- someone correct me if I'm wrong -- $208 billion, 1628 human beings in just one Middle Eastern country over oil. Unless you actually thought it was about bringing democracy to that part of the world.

The problem is that we can't begin to make money selling biobased materials to replace petroleum when nobody in this room has any idea what petroleum costs. Do you really think a gallon of gasoline costs around a buck-ninety? Do you really think that it does?

For those of you who know anything about the fractionation of gasoline, if it doesn't cost between $5.75 and $6.25 I'm missing something. So how can it show up at a pump at under two bucks a gallon? Does anyone want to know? Don't you want

to know how that's possible?

We have a country who is fanatically fixated on the concept that petroleum will solve all of my problems. As a matter of demonstrating, starting with the walls here -- remember, I'm an architect -- to the ceilings, to the floors, to the clothing you're wearing, to the seating and its upholstery system, it is all utterly a function of petroleum. That includes the adhesive binders in the paints.

It represents 78 percent of everything we make. You cannot avoid it. Does it mean you've got to replace every single product item to move to a biomass environment? No. We now know everything you can make from oil molecules from plants, everything that you can make could replace petroleum fractions used for the same product applications.

What's amazing to me is how long it's taken. Think about the people who control this subject and how long it's taking. And my brothers-in-law are absolutely correct. One morning, just to demonstrate the god-awful power of being the first, the second and the largest corporations on earth -- go check it for

yourself -- is that they could buy this entire subject for chump change.

Some years ago, this is 1999 I believe, I tried to find out from the American Petroleum Institute how much money was spent on research. Now remember we're talking about all of the ag schools and all the money that might be available from the federal government and state and local governments to help research of one kind or another to advance the cause of biomass. And the best I was able to determine through a very good friend is about $330 million a day. Not a week, month or a year.

We don't spend that in a year in the biomass community. Think about it. We don't spend that kind of money in a whole year. Universities aren't yet involved in money-making ventures to develop biomass. They are utterly dependent on that same government that is supporting petroleum to find those dollars.

Preparing for today I fell on some certain friends and resources. They include Cargill, Tate and Lyle, NatureWorks, John Deere, Pacific Northwest Environmental Laboratory and some others. Most of you are probably acquainted

with what is called FB4P. This is the federal biobased enabling rule that's been under development, and now it's two years and two months old, that is past its finish date. Very typical.

I made a bet; I won. Now I don't even care. I said that it would be late by two years. It's taken more than two years late. And yet I feel very bad for the people involved. Some of the most competent capable people I've ever met in the federal government, trying to advance this cause. As I stand here, I watch the money evaporate in FB4P enabling legislation as it affects the biobased community.

It's a tragedy how the money has evaporated for each of the programs I'm involved in, which are supposed to help advance the cause. And I don't need to tell you where the money went to instead.

Interestingly enough, and I'm going to tell you while I certainly support, and so does the BMA, support the efforts of the USDA's enabling rule, it's interesting unfortunately that it really looks after the farmer, and it really doesn't advance the biobased community the way I wished it did.

These 11 groups that you see are about half of the ones that the BMA supposes. Interestingly, it leaves out food, leaves out beverages, leaves out cotton. And interestingly, it leaves out ethanol as a primary fuel. Because the whole point of FB4P was to advance the use of biobased materials looking forward, not backwards.

Leaves out agricultural chemicals and pesticides and fertilizers. That's interesting. Leaves out gases and vapor technologies, personal care products; pharmacology, interesting, fabulous opportunity for pharmacology. Leaves out the incidental sale of fatty acids, alcohols, et cetera. I'm not suggesting this is true, it's just a personal opinion, but I can't help believe some of the drafting for FB4P -- yeah, thank you -- was really a function of the petroleum that our world's particular interest in advancing the ruling.

This, by comparison, is the range of products that are represented by the BMA. And let's go through these. I assume all these are available to you through somebody's kind efforts. Notice paper and paper products. These are the big promoters today.

Many of you already know that the Department of Energy is involved in a great deal more than just fuels. Collaborative effort, the FAC that I serve on in Washington with the USDA; DOE and the USDA have probably done more at the federal government level to advance biomass than anything.

Big contender applications in the State of California. It's going to take me two more minutes. These are the opportunities. I don't have the time to discuss why these are the opportunities that we say exist in California. These are new opportunities, not existing business.

Everyone here I hope knows what a composite building material is. I'm going to skip over the references. We can do those some other time.

Very quickly, you'll notice the increase in just biomass conversion. When I came into this industry in 1990 there was virtually no biobased product-ing as we refer to it today. Today arguably it represents as much as 12 percent of most any product category from adhesives and binders to building products to cleaner solvents,

lubricants and certainly fuels.

We've also gone over most of these barriers. I think you'll recognize them. Want to harp for just a minute on the effect of freight. Freight represents between 40 and 70 percent of the cost of goods sold. I have inbound freight and outbound freight in California. It is even higher than any other state today.

Add to that the cost of overhead for operating in the State of California, and I manufacture in Hayward. It's frightening for the prospects of a small company starting out from an entrepreneurial point of view.

Let me correlate these for you. At the top there to the right, the 9 percent would be 450 million, just to give you some reference. And the 6 percent next to it would be 300 million, and so forth. And so obviously fuel, as an application, is by far the largest. It is interesting that all other uses compared to fuel, though, represent about half. They do in most quadrants of the United States.

My opinion is value added. From a value-added point of view, the other crops that might be used -- I'm getting to in just a moment,

have more value in this area than the fuel does from a manufacturer's point of view.

Major feedstocks. Everyone here probably knows that woody biomass is by far the largest contributor. Interesting, the world that I live in, the surfactants, is almost minuscule.

Just as a side note, 4 percent is industrial. Wonder how many of you know that.

Thanks very much.

(Applause.)

MODERATOR VON BERNATH: Okay, now we'll have our last speaker is Chief of Criteria Pollutants Branch, Stationary Source Division, Mr. Simeroth.

He has been working at the California Air Resources Board since 1972. For the last 17 years he has been Chief of the Criteria Pollutants Branch. This branch is responsible for development of (indiscernible) fuels for California. Also for the last eight years, prior to that assignment, he was the Chief of the (indiscernible) Branch.

Mr. Simeroth.

MR. SIMEROTH: Thank you. And I guess my job is to try to keep you here till noon.

(Laughter.)

MR. SIMEROTH: Which usually I'm fairly good at, so give it a try.

I'm going to start out with sort of the mundane part of my talk, and then if you're going to build a facility in California, you really do need a permit.

(Laughter.)

MR. SIMEROTH: And we actually, as opposed to what most people think, there really is a process. There is such a thing as the California Environmental Quality Act. And this has been both praised and damned depending on what side of the Act you're on, when you're trying to build something or you're trying to keep somebody from building something.

Okay. This requires state and local agencies to identify the significant environmental impacts and address those potential impacts. And if you're going to build in the South Coast Air Quality Management District for Los Angeles, Riverside, San Bernardino, Orange County, the South Coast Air Quality Management is probably going to be your lead agency.

If you're going to build in the San

Joaquin Valley, the San Joaquin Valley Air Pollution Control District is going to be your lead agency.

And if you're going to build in the San Francisco Bay Area or the nine counties surrounding the San Francisco Bay, it depends on which locality you're building in. There's no one agency that's going to be the lead agency in that area.

Contra Costa County, if you're near, tends to be the lead agency. The City of Richmond will tend to be a lead agency. The Air Pollution Control District there tends to be a supporter and issuer of the air permits.

Key steps is, first thing, find out who the lead agency is going to be and talk to them early. And find out what they really want you to do and how they want you to do it. Then all these other things will fall into place. Talk to us. If you have trouble finding that, call the Air Resources Board and we'll help you do that.

And the rules of the Air District, San Joaquin Valley, South Coast lead agencies obviously in issuing the air quality permits. Again, talk to them early.

New source review, these are administered by the local districts. Basically if you're going to increase emissions you have to do something to offset it. And if it's not economical for you to offset then they'll try to work with you to develop some way to mitigate as much as you can and then go from there.

We already covered that. Other potential issues. You really do need water permits and you need to talk to CalOSHA if you have employees and toxics come into play and things.

Basically the message I'm trying to get to you there is a permitting process. You do need permits. Talk to your permitting agencies as soon as possible. If you're thinking about building something, that's not too early to start talking to them. Get out there and talk to them, and we'll try to work with you to make this as painless as possible.

Air quality aspects of biofuels. Now hopefully it will get a little more interesting in what's going on here. Keep in mind I'm from the Air Resources Board; my job is to reduce air pollution. And that is really what my function

is, and that's how I see it.

Ethanol. Today virtually all of California gasoline, known as reformulated gasoline phase 3, is blended with about 5.7 percent ethanol, probably averages about 6 percent. Most of that is corn-derived ethanol, and mostly imported from the Midwest.

There are benefits. It does have the potential to reduce greenhouse gas emissions, carbon monoxides and hydrocarbons. There is an issue on permeation emissions. Permeation is evaporation that results as gasoline constituents moving through the -- fuel components.

There is an oxides of nitrogen emission. Our regulations require that you preserve the NOx benefits of the program. If you're putting something in that increases NOx you have to adjust something else to decrease that to retain that benefit. And we have a so-called predictive model; it's a mathematical model that allows you to do that. That model also looks at hydrocarbons and toxics. There is a small carbon monoxide element to allow you to do some offsetting with hydrocarbons, but the model is really hydrocarbons, toxics and oxides of nitrogen.

We will be updating that this year. We should have, for the first time in over five years, a net set of data to allow us to do that. Hopefully that will show that the oxygenates, in this case ethanol, at least on the new technology vehicles, are less of an impact than they've been in the past. But I haven't seen that data yet, so I can only speculate.

Greenhouse gas emissions. What we would really like to see is the ethanol come from cellulosic because you get more greenhouse gas emission benefits by going that route. And hopefully that's going to happen, and the future of California ethanol will be that way.

The permeation emission, it is big, the 45 tons a day. That's more than fugitive emissions from all the refineries in the state. We don't know how to make that up. That's going to be an issue for us. Maybe using more ethanol is one thing that will help. But that comes at the other penalty of what do you do to offset the NOx issue for the ethanol.

I don't have a slide for E85. One of the things we've been looking at recently in staff at the Board is there's limitations on putting

ethanol into gasoline. And whether it's 6 or 10 percent, that's still a relatively small amount of the total gasoline. Gasoline is still 90 to 94 percent petroleum-derived.

Is E85 another answer? We're starting to explore that. That avoids the permeation issue; it avoids the NOx issue; it avoids a lot of other things. About 1 percent of our cars are flexible fuel in California today. Those cars could potentially be fueled on E85, 85 percent ethanol and 15 percent gasoline. I'm not saying E100 because there's some safety issues we'd like to avoid, so mixing gasoline in actually helps solve some of the safety issues. And solve those, it doesn't necessarily have to be gasoline. It can be some other like components.

Biodiesel. Everybody knows what biodiesel is. At least according to our definition, it's methyl ester of fatty acids from animal fats, plant oils and recycled grease.

Emission benefits, again greenhouse gas emissions. Generally lowers tailpipe emissions, carbon monoxide, hydrocarbons. Keep in mind diesel engines are not a big contributor to hydrocarbon and carbon monoxide emissions in

California. They're around a few percent of our emission inventory for hydrocarbons and carbon monoxide.

On the other hand, the diesel engines that do exist, there's about 4 percent of our vehicle inventory is diesel, contribute about 40 percent of the NOx emissions. So although those NOx emissions may seem small compared to the reduction in hydrocarbons and carbon monoxide, to us it's not small, from the air pollution perspective.

We have a reformulated diesel program. That reformulated diesel program achieves about a 7 percent NOx emission reduction. So for 7 percent, reformulated diesel. So now you're talking about a 10 percent increase. That gives us a little bit of concern.

Specifications need to be addressed. There's still no B100 ASTM specification. There is one for B100 to be used as a blend component, feedstock. And there's also some oxidative and thermal issues for the B100. It would be good to have ASTM come up with that specification. Greenhouse gas, it's good on greenhouse gases. And it also depends on what it's made from. And

let's go to the next.

Exhaust emissions. I've already touched on some. Let me back up. One of the -- oh, that's going to come up later, never mind, sorry. Getting ahead of myself.

Biomethane background. There is biomethane being produced in the state, mostly in landfills. There's some agricultural production that's starting to come into play; a lot of it at dairies, used for production of electricity and heat, used as a motor vehicle fuels, CNG.

The trouble with that generation of compressed natural gas or natural gas is that it doesn't simply contain methane; it contains other things such as hydrogen sulfide, oxygen, water, ammonia and benzene, -- ethyl benzenes, xylene. It needs to be cleaned up before you use it as a fuel is the bottomline there. And that adds expense and other things.

There needs to meet motor vehicle fuel quality specifications if you're going to use it to fuel motor vehicles. And that's further cleanup.

It does reduce greenhouse gas emissions. Emission benefits from the vehicles are the same

as CNG because it would have to meet the CNG specifications. So, by definition, it's a good fuel.

And you've heard earlier, gaseous fuels are difficult to use; they're not getting the market penetration we thought they would. That's generally true, but there's still a lot of compressed natural gas vehicles out there. We expect more to be seen in the future. And I don't think CNG is going to go away as a motor vehicle fuel.

Directly reduces methane to the atmosphere, rather than at landfills, it permeating up through the soil. And agricultural degeneration going directly into the air. It's got a nice benefit there.

So, policy issues. (inaudible) more biomass-to-energy use. The economic incentives usually work fairly well, but not always. It's got to be something the consumer sees as convenient. And it's got to be out there available to the consumer. And economic incentives will do part of that, but it won't do everything.

Biodiesel is a good blend component into

diesel. And if you look at our regulations for reformulated diesel it says you got to reduce aromatic hydrogen content; you got to increase the cetane, the octane value of diesel. You got to have, starting June 1st or July 1st, 2006, you got to have no more than 15 parts per million sulfur in diesel in the state. And that's virtually for all diesel in California, not just onroad.

Biodiesel has very little sulfur; has virtually no aromatics; it has very high cetane. Good blending component. If we can just get the oil companies to blend it in now.

But our regulations are set to encourage its use. Same thing occurs through the Fischer Tropsch or gas-to-liquids source of diesel. They have the same virtues as the biodiesel. Again, we're waiting for them to blend it in. They've been blending it in in very small amounts.

Biodiesel has an opportunity to expand our supplies of diesel fuel. I'd like to see that happen. I heard earlier on gasoline and our consumption of gasoline going up, the consumption of diesel is double in terms of the increase per year in gasoline. So that's, in the future, a bigger issue than our gasoline supplies.

Address future technologies. Continue our research program; it's relatively modest. I'll be the first to admit that. Coordinate activities between academic, government, industry and the public. Today is one example of that; we're trying to get into other things.

Promote new technologies. We actually have programs to do that where we'll award grants to people coming up with new technologies that qualify, anyway.

New fuel specifications. If you're going to have a successful motor vehicle fuel you need specifications for it. Otherwise what you'll have is varying qualities out there and consumer dissatisfaction with the quality of the fuel they're getting and the performance it's providing their vehicles. And that's the purpose of the fuel specifications. Fuel specifications aren't going to result in people using your fuel. That happens through other things, other incentives.

Which comes the next one. New legislation to establish incentive structure, determine a revenue source. What we now have is basically tax incentives. Probably that would be a revenue source in the future.

Should that money be used for E85? Should it be used to help make biodiesel more acceptable? Or should it be used to help ethanol stay and become more acceptable for gasoline, blending into gasoline?

Those are sort of the issues there on that legislation. And this legislation doesn't exist, at least not to my knowledge. But we need something like that if this is going to be successful.

And that's, I think, why you're here today, is how can you be successful. And there's no silver bullet out there for fuels. The closest thing we've found to a silver bullet is getting the sulfur out of petroleum fuels. But that only goes so far. And after that you've got to compete and you got to compete successfully with your largest competitor. And that's petroleum-derived fuels.

And if the oil companies aren't getting it from petroleum, they'll probably get it from coal or something else, natural gas. They're very creative in this area, too. As you heard, their research dollars dwarf ours by orders of magnitude. We're not going to compete with that.

The other thing, in terms of air pollution, air pollution alone cannot be the savior for alternative fuels. It's got to be energy diversity, it's got to be these other things.

Today manufacturers of vehicles are producing cars that burn on gasoline that have emissions equivalent to electric vehicles, when you consider the electricity, the generation of the electricity, and getting it to where it needs to be, et cetera, emissions are about the same.

Now, there's some greenhouse gas and other things that have to be thrown in there. But in terms of air pollution, in terms of what we traditionally recognize as air pollution, that's not going to be the carrier for the future programs. And I am done, thank you.

And so we have to recognize that; we have to deal with it. And we have to have some new partners in the development and pushing for these fuels.

And with that, I will thank you.

(Applause.)

MODERATOR VON BERNATH: Please, and now if you want to have some questions to the

speakers, please go to the microphone. Please say your name and the name of the company or the agency that you works, so the recorder can have that information. So when all this appears in the websites, you can see who asked the questions.

Some have questions to the speakers?

MR. COX: This was very interesting. I'm Mike Cox from Anaerobe Systems in Morgan Hill, California. But one of the things that I see in the two different presentations regarding hydrogen I've looked at, I'm a bulk user of hydrogen. And I pay $6.60 cents a hundred cubic feet, which makes a gallon gas the equivalent of about $13.20.

So I don't know how we'll get to $2 a gallon gasoline -- and I'm buying it wholesale, and that's before it's delivered to a car. So that's my first question I suppose I'd like to ask.

DR. OGDEN: Well, the price you pay for hydrogen depends a lot on how much of it you need and how far away you are from where they're delivering it from. And I'm not sure what the total throughput of hydrogen that you use is, but I know for many people that use it in, you know,

relatively small chemical applications, that sounds like a perfectly reasonable price.

When you start getting to the scale that would dispense as much energy as we do at a gasoline station today, or a little bit of both, the price generally goes down. And I'm not sure what form you get it delivered in, whether it's a liquid or a gas or whatever, but I think for a small industrial user that sounds pretty reasonable. The scale looking at it is a bit bigger, so go down the scale.

And the other thing is if you imagined in the far future, and we're talking probably several decades from now, if you delivered this stuff in pipelines like you do with natural gas, the cost for delivery would go down even more.

Now a lot of that cost is not so much the cost of producing the hydrogen at a big steam reformer plant, it's more liquefying it, storing it, putting it in a truck, driving that to where you are and those sorts of things.

So maybe the take-home message is for a gaseous fuel like hydrogen, it's got low energy density, the storage and delivery part are a much bigger part of the total cost than it is for a

liquid fuel.

MR. PEAK: Joan, this question is for you, also. My name is Matt Peak; I'm with CalStart. I was wondering if you could speak a little bit about the -- a little bit more about the potential for biofuels, in particular ethanol for use in fuel cells. And specifically I'm interested in knowing if you do any work, or what your opinion is on direct ethanol use in fuel cells, not through the use of a reformer.

DR. OGDEN: Okay. I'm not terribly familiar with direct ethanol fuel cells. I know people are trying to do this. It's harder than it is, say, with direct methanol, because of activation energy, it's harder to make it work out in a fuel cell. And both of those are quite a bit more difficult than hydrogen.

Hydrogen is the easiest thing for a fuel cell to use; it's the hardest thing for the -- infrastructure, you know. And ethanol or a liquid fuel is easier in the other regard.

But I guess I'm not doing any work on ethanol -- direct ethanol fuel cells right now. I know there is work, you know, going on; that people are interested in that idea. There's

certainly been a lot of work on direct methanol fuel cells. And some degree of success with that.

Really, the tradeoff is whether you have a device onboard, the reformer, and couple that to a fuel cell versus trying to make a fuel cell that runs directly on liquid fuel. And people have made onboard reformers. There are certain difficulties with getting those to run dynamically. You have to have a small chemical plant in the car.

But there are also issues with the direct, you know, fuel cells using other fuels than hydrogen. Hydrogen is the easiest one for a fuel cell.

One thing you might say about ethanol is it's a high temperature fuel cell. And those aren't so suitable for cars, but they might be for local or stationary power.

MR. COX: I had one more question for Neil, if they've looked at secondary fermentation from the distillers grain, and to use this. Because about half of the groceries that go in the top of the fermenter is still left at the bottom of the fermenter when they're done. So if we could take the secondary fermentation to other

products.

MR. KOEHLER: We're not looking at it in our first plant, but there's a lot of research going on in how to squeeze more out of the distillers grain and out of the bushel of corn.

In fact, I didn't really mention it, but certainly John Ferrell did this morning, a lot of the cellulose work that's going on now is with the grain industry. And there's no question that really the first commercialization of cellulose ethanol technology is going to be in corn ethanol production, taking the cellulose in the fiber that's left over from corn.

So, you know, we're looking at doing things on the distillers grain that are related to really adding value to the feed by supplementing it with -- because it's a wet feed, it's one of the big advantages of producing ethanol in California is you don't have to dry it, distillers gain, because you're local to the market. That's good news for the environment because you use 30 percent less energy and you have a better feed. And because it's moist, it becomes a nice carrier. So to adding minerals and other supplements that the dairy adds at the dairy to actually use that

wet feed and produce more of a specialty feed as opposed to a commodity feed. Those are the kind of things that we're looking at right now.

UNIDENTIFIED SPEAKER: Cows love it, too.

MR. KOEHLER: Yeah, they do.

MODERATOR VON BERNATH: Do we have more questions? Okay. Since there is none, thank you very much.

(Applause.)

(Whereupon, at 12:00 noon, Session II, Biofuels and Bioproducts Presentations, was adjourned.)

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CERTIFICATE OF REPORTER

I, CHRISTOPHER LOVERRO, an Electronic Reporter, do hereby certify that I am a disinterested person herein; that I recorded the foregoing Session II of the Second Annual California Biomass Collaborative Forum; 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 forum, nor in any way interested in outcome of said forum.

IN WITNESS WHEREOF, I have hereunto set my hand this 15th day of March, 2005.