Session I

P R O C E E D I N G S

8:40 a.m.

DR. JENKINS: It's good to see you here this morning. Welcome to the Second Annual California Biomass Collaborative Forum. I am Bryan Jenkins; I am Executive Director of the Collaborative at the current time. And it is really a pleasure to see you all here this morning. We have an excellent program lined up so I'm looking forward to hearing it.

A few logistics I need to go through today, but I do want to give you a little bit of background on the Collaborative and tell you a little bit about what we've been doing and what we might be doing, and of course, we're looking for input from you today. This is not just us up here standing here in front of you to talk at you, but we'd like to hear what you have to say today. And we've allowed some time in the program to get your comments and your questions.

So let me just indicate, remind you the mission of this Collaborative is to enhance the sustainable management and development of biomass in the State of California, and all that that entails.

And so we are encompassing. We deal with all the issues associated with biomass. And this really provides a forum for all of us to get together and talk about the various issues in biomass, and there are many, as we all know.

The need for sustainable management and development probably goes without saying for most of you. There are lots of resource issues in this state, extending all the way from the forests to agriculture and municipal solid waste from the way we live. And so we really do want to address these.

To give you some refresher on what you told us last year about what was important to you, this is just some results from the survey that many of you completed. If you were here last year, you completed hopefully the survey. And this just indicates what was important to you then, and we'll hear hopefully from you today as to what is important to you now.

As you go down the list here these are ranked in order of importance from high -- the length of that bar indicates the importance here. So you can see lack of a state biomass policy, we'll hear more about that in today's program.

Lack of financial benefits, of course. Unequal biomass policies; state environmental permitting; regulations; siting; connectivity to the grid; and you can go on down the list there. I don't know what you can see back there.

But basically what it means is that we are very much interested in how we're going to manage biomass in the state, and that we need to do something about that.

In terms of what the Collaborative has been working on over the last year or so, we have a whitepaper that is coming out on biomass. You'll be able to get that off the website for the Collaborative here sometime soon. It was discussed at the executive board meeting of the Collaborative yesterday. There will be some additional changes made in the near term and then we'll get that up for your general review. We'd like to have your comment on that paper when that comes out.

The Collaborative also maintains and is developing a biomass facilities reporting system in which you can try to obtain information, or can obtain information on facilities in the state. If you are operating a facility you'll see, in a survey that we've distributed with your package today, that we'd like to know about that facility. And if you can provide us information on that, we'd certainly be happy to include that in the biomass facilities reporting system.

This is really to try to get a measure on the status of the biomass industry in the state. And that doesn't mean just power facilities, it means all types of facilities that deal with biomass.

We have done a power generation assessment. That's in draft form. That report will be up on the web, as well, for your review, trying to analyze just the power sector. We are, of course, interested in the other sectors of the industry.

And we've published a biomass resource assessment. That's a 2003 year based assessment. That's been up on the web for some time, if you've had the opportunity to see that. We are working on an update of that resource assessment and will be continuing that. So, we'd certainly like your input on that.

And, of course, we have been planning for this forum. And that brings us here today.

And it's, again, a pleasure to see you here.

What are we planning to be working on over the next year or so? We have a proposal with the California Energy Commission, who is our primary sponsor at the current time. And, of course, we're also interested in other sponsors for the Collaborative.

But we will be working on developing a roadmap for biomass development in the state. And we certainly need your input on that and value it. And so we hope to get some of that today in today's program. And then as we go through the year we will certainly be looking for your substantial input for that effort.

We are trying to work on education, training and outreach on biomass issues. We want to maintain the biomass facilities reporting system. We will continue to update the resource assessment, as I mentioned. And, of course, we will be planning for the next forum. So hopefully we'll see you, if not here, someplace else next year about the same time.

And participating in all of this, of course, are a number of people who you'll hear from today as speakers, but they're also sitting in the audience among you. And these are members of your executive board. We have a board of 25 people currently. And you can see how this board is comprised. We have members from the industry, from the state government, from the federal government, from national laboratories, the environmental community and from the academic community, the University of California currently.

So, I think, as you go through the day, you can find the people on the executive board as they introduce themselves to you. Please extend your regards to them for all the hard work that they've put in getting us towards this vision of sustainable management and development for biomass.

In case you are not aware of it, we do have a website and you can always send us email. The website is just biomass.ucdavis.edu. And the email is the same with an @ symbol in there. So, feel free to give that -- I believe that appears on your program if I'm not mistaken, somewhere. Maybe it doesn't, but -- and the newsletters. There are some newsletters from the Collaborative. If you're not getting the newsletters now, please do go on the website and sign up for membership in the Collaborative and you will receive the newsletters. And, of course, we do put the reports that the Collaborative produces on the website, as well. So you'll see those there.

Now, a little bit about today's agenda and the logistics here. The morning session we'll have two keynote presentations. We'll get to those very shortly after I get done with what I'm saying here, fairly quickly.

And then we have two concurrent sessions this morning. So, we don't have time in the program today to get everything in. We did split up the morning session into one on biopower and another one on biofuels and bioproducts. Unfortunately, you will have to choose among those. You can rush back and forth between the sessions.

The biofuels and bioproducts session will be in the next room over here, the Coastal Room. And the biopower session will be in this room, in the Sher Auditorium.

The lunch is provided with the registration, so we will have it here. I believe that will be catered out in the lobby there.

And then in the afternoon we have

Mr. Desmond coming in, who will give us a keynote speech about a comprehensive biomass policy for the state.

And then we have two sessions, one on resources and environment and another session on financing and economics of biomass projects.

And then we'll wrap that up and hopefully be done about 5:00 this afternoon.

And just to remind you, there's a survey form in the packet that you received. We would like you to fill out that survey form. We're interested in what you have to say. We would like to have that back by the end of the day, but if you're not able to complete it, please take it with you and mail it back to us at your earliest convenience. We would like to summarize those and get those out to you, as well.

We have a fairly comprehensive program today. A lot of speakers. The time is fairly tight, but we'll try to keep the speakers on time. We have a nice set of moderators to go with the session today, so hopefully we'll get through on time.

Our first keynote this morning is from the California Energy Commission, Mr. Jim Boyd, who is a Commissioner at the Energy Commission. And the Commission, as I mentioned, is our primary sponsor and really has been the key driver for the creation of this Collaborative and keeping it functioning.

And Mr. Boyd, of course, is well known throughout the state. He serves on a number of committees with the Energy Commission, including the Renewables Committee. He has a long interest in biomass and has really been very active in this area.

And without further ado, I think I will introduce Mr. Boyd. And he's going to talk to us on accelerating renewable energy in California and the role of biomass. Mr. Boyd.

(Applause.)

COMMISSIONER BOYD: Thank you, Bryan. Good morning. It's a pleasure to be here again for the now Second Annual Forum of the Collaborative. I've got to get to these things nowadays, it's become a necessity.

The theme of this year's forum has particular meaning to me, the theme being sustainable management and development of biomass in California.

The reason I say that is that the issue of sustainability and sustainable development has become quite the buzz these days. However, I believe unlike many of the other words that became the buzz and disappeared, I think our society has come to the point where it really does recognize the value and importance, and if not the absolute necessity, of looking at this concept of sustainability in various areas. And energy is certainly one of them.

People are beginning to recognize that it's not a bottomless well, let me just say, in terms of energy and its availability.

So I think embracing sustainable development and sustainability and dealing with sustainable management in this arena is going to serve those of us who have continually advocated dealing with biomass, it's going to serve us well.

Another major reason is people, in looking at sustainable activities, start taking a systemswide look at things, which is something that's near and dear to my heart, and gets people to start crossing over among and between all the various components of our society and of the various issues, all of which affect each other.

And in particular that's important when you start dealing with the economics. To me it's been the economics continually that has frustrated us in our efforts to deal with this issue of using our biomass in a very positive way in this state. Lord knows how many committees and commissions I've served on down through the years where things don't pencil out in a conventional way. And how many of us have argued for the fact that you've got to look at a broader picture. In any event, I want to dwell on that for a moment because I think it bodes well for us.

The Collaborative, of course, is a very valuable public/private partnership, as we see it, at the Energy Commission. And I think is -- I know is an outgrowth of the original interagency biomass working group that many of you may have served on for several years, and saw the need for a public/private partnership, and thus the Collaborative came to be. And I think it's extremely important and is going to be that much more important to us in the future.

I think it's pretty obvious the Energy Commission has had a long-standing relationship with the biomass industry here in California. We have worked very closely with members of the Collaborative, wearing other hats in the past, and certainly with other state and federal government entities to address many of the financial and regulatory issues that have confronted the subject of biomass.

Unfortunately, however, some of these issues still persist today. And, as I said a moment ago, the need for the Collaborative is greater today frankly than it has ever been. But the opportunity for success, I think, is greater than it's ever been.

While biomass has been an important source of renewable electric generation, and certainly has a potential to contribute towards meeting the state's new renewable portfolio standard or RPS goals, it provides benefits far beyond electricity alone. And hopefully more and more people are beginning to recognize that.

It, of course, addresses -- addressing the subject addresses the larger societal issue such as reducing, you know, our solid waste that we have to deal with and that goes into our landfills. Dealing with the consequences of the gases that are generated in using landfills. Some of that resource has been tapped in the past to generate electricity.

The ever-difficult subject of promoting forest management and fire prevention. And the continual driving force of dealing with eliminating air emissions from open field burning. And dealing with just a host of other agricultural waste problems. These are all issues that are tied together in this system that we call biomass, or those of us in the energy business might start saying more and more often, deals with the bioenergy issue that so many of us want to deal with.

Through the Integrated Energy Policy Report, or as we're trying to call it to cut down the size of the title, the Energy Report of the Energy Commission, I think we've been reasonably aggressive in our support of renewable energy development in California.

The Integrated Energy Policy Report is a new document and a new vehicle that was provided the Energy Commission by the Legislature in legislation introduced by Senators Bowen and then joined by Senator Sher a couple of years ago during the depths of the energy crisis, calling upon the Energy Commission to produce, every other year, an indepth totally integrated energy report and recommendations for the Administration and the Legislature.

And it provided that in the intervening years the Energy Commission could address particular subjects that it had identified in the main body of the report.

So in our 2003 report we called for the enactment of legislation to require all, all, I'll say twice, retail suppliers of electricity, require that they all meet the RPS goal of 20 percent of retail electricity sales, and that we accelerate the target date for reaching RPS goals from 2027 to 2010.

Now, that is the policy that was adopted in the Energy Action Plan that was initiated by the PUC, the CEC and the California Power Authority, which has now lapsed. So we have the PUC and the CEC still carrying that forward as policy.

In our 2000 report update one of the subject areas that we addressed was the subject of the RPS. And we again called for legislation to accelerate the RPS goal.

Significant progress has been made in this state to address and achieve the goal, the 20 percent goal, even by 2010, which utilities and others recognize as our policy.

Frankly, though, however, unless the state sets out longer term renewable targets for 2020, important momentum could be lost in achieving the maximum fuel diversity and environmental benefits that renewables offer us, and particularly offer the state.

And this is why we also pushed for adoption of the Governor's goal of 33 percent by 2020. And we are again addressing that in the 2005 Integrated Energy Policy Report activity that's been underway for some time.

This report provides basically a full-time, real-time forum for the Energy Commission and affected public to address all energy needs and issues in the state.

Also, in the 2004 update, the Commission recognized what you in the audience have long known, that the state needs to develop a better strategy to allocate the external cost of biomass appropriately to those who benefit my continuing harping on the idea of looking at the system and all systems aspects and costs.

This has not been, and continues to be not an easy task. It will take coordination among the various state agencies and stakeholders. And it's likely to rely on more forcible directives from many agencies, particularly perhaps the air quality and waste management regulators in order to carry it out.

The task ahead is to find innovative ways to allocate electricity benefits to ratepayers while insuring that electric ratepayers are not burdened with costs that should be paid by society as a whole, or by the segments of society who directly benefit from the use of this biomass. And frankly, we look to the Biomass Collaborative, this public/private partnership, to play a very important role in achieving this effort.

In our 2005 Energy Report we're looking more closely at the role that transmission access and planning for transmission can play in accelerated renewable energy development. And those who follow this subject closely know the heated issue that we've gotten ourselves into with transmission planning and transmission access. And I'd just encourage you all to continue to play the role and continue to focus on this subject.

While the focus of the Biomass Collaborative has been, to some degree, and is -- I don't want to say is, but has been power generation, there is growing interest in the use of biomass resources for transportation fuels, biodiesel, biomass-to-liquids, which rivals gas-to-liquids, so-called Fischer Tropsch fuels, and biogas. And to the extent permitted, the ever-present ethanol.

Unlike other states, the transportation sector in California -- I should say other states and frankly most other nations -- the transportation sector in California is the single largest emitter of greenhouse gases.

On a wells-to-wheels basis biofuels could make a significant contribution to reducing greenhouse gas emissions in California. This is another subject we talked about in our 2003 Integrated Energy Policy Report, an area we're devoting a lot of effort to in the 2005 report. And, of course, this whole issue of energy security, energy diversity was addressed in the almost infamous report on reducing our dependence on petroleum in California, which we still are striving to see carried out.

Transportation fuel in this state has become one of those issues that the public is keenly sensitized. We've gotten past the point now, I think, through more than two years of continued price spiking, of just presuming that it's a product of let's say price fixing or unwanted collaboration between oil companies and what-have-you, to just the pure simple supply exceeds demand. And for whatever reasons, the ability to provide conventional transportation fuel supply in California cannot keep up with the demand.

The dreams that were laid forth back in the days when we produced cleaner burning gasoline, of importing fuels from all over the world, and it's become a fungible world market, have not come true. Primarily, I believe, because the third world has rapidly caught up with the rest of us in its desire for mobility, transportation. Everybody wants an automobile. And the demand for refined products, as well as oil, throughout the world are at unbelievable record highs.

So the importance of energy security

through energy diversity are really coming home to roost here in California.

Therefore, stretching our conventional fuel supply is a real=time, right-now necessity. While we continue to strive, as many of us have for years, to introduce alternative fuels. And, frankly, to work to assemble the bridge, which is a fairly long bridge, to the hydrogen highway.

But, in any event, I see the real big push right now for biomass is to help us in our transportation fuels arena. And there's been a tremendous amount of work done just in the last, well, last year, and even the last few months, on beginning to really push the subject of these types of fuels that I mentioned before.

In closing, let me just say that we, at the Energy Commission, are frankly seeking to capitalize on the commonalities between various applications of biomass resources. And I think, as you'll hear later today in the keynote from Deputy Secretary of Resources Desmond, you'll see that we've been working diligently of late to breathe new life into the subject of biomass and the need for state policy in the biomass arena.

So I'll close by saying that I believe

today you will see, in talking amongst yourselves and hearing from other state representatives, that the need for the Collaborative is greater than its ever been. And the need for a very strong relationship between the Collaborative and all government agencies, be they federal or -- I'm looking at my good friend, John Ferrell over there -- federal or state agencies, the need for that relationship to be strengthened is stronger than it has ever been.

And we have a real keen need for cooperation and sharing of scarce dollar resources and what-have-you. And I frankly look forward to that happening with vigor over the next couple of years.

Thank you very much for allowing me to help kick off this event, and trying to give you a little bit of an idea and maybe a little optimism about where this subject is going again. And this time I think we're going to score.

In any event, I hope we have a very good forum. I look forward to seeing more of you throughout the course of the day. Thank you.

(Applause.)

DR. JENKINS: Commissioner Boyd, thank

you for those remarks. I think our task is clear before us now, so looking forward to a lot more interaction with the state agencies and with the rest of you here as part of this Collaborative in moving forward with the objectives that Mr. Boyd put before us, like power, the transportation fuels and products, as we'll hear about today.

Our next speaker is -- if I can escape here -- sorry for that -- I'm not very good at this.

(Pause.)

DR. JENKINS: My apologies for that. Our next speak if John Ferrell. Sorry, John.

(Laughter.)

DR. JENKINS: John is well known; John has been with DOE for a long time, U.S. Department of Energy. And he is currently lead of the feedstock conversion platforms with biomass technology development for DOE.

He's done a lot of different things in his position over the years at DOE. He served as the Designated Federal Officer for the Biomass Technical Advisory Committee, which oversees programs at DOE and USDA and other agencies on biomass. And he's been working on really, for the feedstock on the thermochemical conversion and sugar platforms for DOE on the biorefinery operations.

He's going to tell us a lot about what the current DOE thinking is on this. And so he's going to tell us about federal goals for biorefinery development, and implications for fuels and power in California. John.

(Applause.)

MR. FERRELL: Well, that was quite an introduction, I'd say. This is actually my second forum, too, which is, from my perspective, kind of interesting in itself. I noticed coming in today from Davis one of the roadsides caught my attention particularly. It said, Sacramento 10 miles, Ocean City, Maryland, 3073 miles.

Maybe that gives some perspective in some ways how we maybe are different. But I think there are implications, you know, we do have a slightly different orientation, I think you'll hear. But I know that you're in the process of developing roadmaps and I presume that what follows roadmaps are implementation plans and so forth. So I'm hoping that some of what I have to say today will be applicable to California, although I certainly wouldn't be the one to draw the implications. I think there are a lot of people here that can do that better than I would.

So, I am with the Office of Biomass Program in the Department of Energy. We are part of EERE, which is the kind of parent organization that covers all renewables and energy efficiency technologies at the Department of Energy.

And we take our strategic direction really from them. And in their portfolio priorities, the red ones, we really do relate -- hopefully you can all see that back there, but maybe not. So I'll read a little of this.

There are really three areas that we feel that the biomass program is most significant. One is certainly the reduction of our dependency on foreign oil. Secondly, increasing viability and deployment of renewable energy technologies. And the third one which is unique to biomass is the creation of the bioindustry.

And from a legislative standpoint we get our driver, our major driver has been over the last few years the Biomass R&D Act of 2000. And interestingly enough, as originally passed -- you kind of have to remember who the sponsors of that bill were, that it was Senator Luger from Indiana and Congressman Tom Ewing from Illinois. And so it had sort of (inaudible) flavor to a degree.

And when you look at the findings (inaudible) really mention biorefineries in the original R&D Act was that recognition that grain processing -- are biorefineries that produce a diversity of things. And that technologies that result in the diversification of value-added products. I think that's kind of the key here, are one of the keys for the expansion of this industry.

And I think if you kind of keep that, would be one of the things, I think, that you'd want to take home from my presentation today.

So, in terms of the biomass program, basically in terms of work breakdown structure, look at the interface issues; we looked at conversion technologies and products; we even integrated biorefineries, the theme of today's meeting.

And what we have really kind of, you know, in addition to kind of looking at the individual elements, what we really have done, and this kind of, I think, mirrors what Jim said in terms of a systems approach, is that we're looking at pathways. How do you go from the feedstock through to the biorefinery. And that's been a big change in our thinking over the last few years.

And as you may have noted from that last slide that the pathways all begin with sort of the resource base. And one of the questions from kind of the federal standpoint is with regard to biomass, is there enough of it out there really, from a transportation standpoint, or from an energy standpoint, to have some significance. Does biomass really have legs.

And what we've done, and this was a study that was led by Oak Ridge National Laboratory that included the Idaho National Lab and National Renewable Energy Lab, as well as -- and this is very important in this particular case -- a number of USDA agencies including the Forest Service, Agricultural Research Service and the Office of Energy Policy -- under the Office of the Chief Economist. So it was a joint DOE/USDA study. It has been recently drafted. It is available on a website which I'll give to Bryan. You can post it on your website. But it's basically http:\\feedstockrenew.ornl.gov. And it does create a base for biomass.

And basically the conclusion of the study, again the question asked that relates to it, is that there are sufficient biomass resources to meet 30 percent of the country's petroleum requirements. This is quite a statement in and of itself.

The study was done, like I said, with USDA, and so a number of caveats in it that I think are important to kind of look at this study in this reference. First of all, it didn't really have a timeline associated with it. In other words, it's not a 2020 goal, or 2025 or a whatever. But it does say there are resources out there. It does pretty much stay with current agricultural practices for the most part. It wasn't a radical kind of position taken from that standpoint.

It does try to maintain export markets, that kind of thing. It kind of, I won't say sidesteps, but it does take into account the issue of trying to meet our feed and fiber export demands, that kind of thing, and still have something significant.

It does -- would require some policy

changes, but it really doesn't address policy in a big way. I think that it will be a source document that a number of folks will cite and use for their purposes and perhaps develop policies based upon it.

So it does show 1.3 billion tons that could be produced from biomass, which is significant, I think.

Okay, so those are the pathways. And they all start with feedstock. And what we've tried to do in the Department over the last year really is to fully adopt this biorefinery approach. And so we have developed kind of a hierarchy, a milestones along different pathways.

And the A milestone, or the top milestone in our program is the biorefinery. And there can be a number of different pathways leading to these A milestone biorefineries.

And then in the hierarchy of things, B milestones that stand behind those. And B milestones are really economic targets of the various components and what has to be done in order to meet those. And so basically in order to actually reach an A milestone you have to meet all your B milestones.

And there are a number of projects, and the project level milestones start the C level and so forth. So, if you're confused so far, don't worry about it, we've been working at it for a year; we still have questions about this. But it is a hierarchy; it is a way to go forward; and it does help set the base. And so I'm going to show you three or four slides on pathway development and our current thinking.

Basically -- agriculture sector. And this is, again, back to their own base and sort of where we begin in biomass. We have divided up the agricultural sector. And you can see in the back that we have the wet and dry mills, the oil crops, ag residues and perennial crops on the ag side.

Those that can see the green parts are basically areas that we have fairly significant programs going on. The yellow are sort of in the middle. And the red are things that we don't do much at all. So we recognize a lot of different pathways.

And as you can see, I think, that we have a fair amount of work going right now for the near term on looking at the wet and dry mills. And if you look over there in the third block under those particular pathways, you'll see under industrial partners a number of fairly large players that are involved.

I'm going to go and talk about some of those, hopefully not in too much depth, but at least to give you the flavor for them. And kind of how the products can be -- high value products, (inaudible) and energy, how they can come together in the agricultural setting to at least serve as a model, just trying to move these pathways forward and hopefully meet our milestones.

So, that's the ag side. This is the fuel side, the other side of biomass. And we do have some work going on -- well, one part way through the Congressional direction, the black liquor gasification piece is in there that we've been working on.

And we've also looked at recently we've had a number of meetings with the pulp and paper industry. One of their interests is really looking at predigester technologies that would kind of pull off the C5 sugars from the predigester stream, the -- cellulose type material, and look at the possibility of converting that to ethanol and other high-value chemicals.

And if you take the C5 stream off from the biomass then what (inaudible) paper quality, which is really, you know, what they're really -- their core product is. And so instead of an initial study, NREL is looking at being able to take off the predigester stream. That's gone pretty well.

And then we're actually collaborating with the Forest Products Laboratory of the USDA looking at taking that substrate out of the system and sending it there and running paper quality tests and those kind of things. And we should know within the next couple of months, really, whether or not this is going to work. But it does have a fair amount of promise for the pulp and paper industry at this time.

I know there are a number of people from the forest industry here. I'd say, you know, given our resources at this point in time, and the economics of penciling out that Jim mentioned earlier, we're not doing as much with forest resources at this point in time, compared to ag based. But we still think it's important, and funds permitting, and as things move along and

California certainly could be the lead here, we'll look at other opportunities down the road.

Okay, so that's the pathway story. And the other kind of overlying thing that we do in running our program is looking at kind of the pathway, the biorefineries, and then how do you manage the overall system. How do you know whether you have made your goals, that sort of thing.

And in order to do that, what we have done, we've adopted it from the private sector really, is go forward with what we call the stage three management approach. And it's actually been -- we pioneered it a few years ago in the biofuels area. And it's been picked up and now made really a part of all the management practices within the energy efficiency, renewable energy part of DOE.

And we kind of used the DC Metro, I guess, line. So they do have a blue line. And the blue line is the commercial path line. And goes through a number of stages from preliminary investigation through detailed investigation, development, validation and eventually the commercial launch.

And then we have an orange line which is more I guess geared to the research side, which looks at exploratory research, development research, technical support, that sort of thing.

And there's certainly a linkage between the blue line and the orange line. There are also a number of numbers, as you can see up here. And those numbers become the gates, the gates between the different stages as we go through StageGate.

And there are a number of questions that need to be answered in a positive sense in order to move from one gate to the other. And so that's kind of the process that we're using to help manage the projects, to see where we're doing, to see whether or not we should turn things on, turn things off, those kind of things.

I think the other thing that, you know, as I mentioned, we did adopt this from industry. And one of the differences, looking at it from a government perspective, is that you have this whole issue of cost share. And basically what that means in terms of StageGate is that as we move toward commercialization, we move through the various steps in order to reach commercial launch, that the percentage of cost share from the nonfederal sector, or the nonstate sector, I guess if you're adopting it to California, goes up.

And this, you know, I think makes a lot of sense. And so on stuff there's perhaps higher risk, maybe higher reward, but higher risk involved in industries, were in this to put more money in. And by the time I get to the proof or concept or the pilot scale, we'll have an industry cost share of at least 50 percent in order to move forward. And that does tend to leave out a number of companies. But it also, given the limited investment, I think increases our probability of success. At least that's the thinking here.

And so there are a number of ways that industry can participate in various parts of our program. And we do have -- on platform, what we call platform R&D, which is kind of the core technology that we're supporting, what we call the sugars platform, or thermochemical platform, the conversion technologies.

Like I said, we have at least 50 percent cost share on biorefinery type projects. We're gearing toward a 2008 solicitation. That's really where the program is headed. And we're trying to position and work with companies and be ready for that. And obviously that would require a much larger level of funding than we currently have. But that's the intent of the program.

Okay, yes, if we ever get the A milestone met, which we talked about earlier, that's really where the program pretty much stops more or less. I'm going to talk a little bit about deployment at the very end and how we might be able to support a commercial launch. I really am just going up through demonstration, engineering, validation type of efforts. That's pretty much as far as we can go in our current world.

Well, I'm going to be going through a number of industrial partnerships and biorefinery partners that we are currently supporting or have been supporting in the last few years.

One of the areas that we have been focused on, and this certainly relates to the need to lower the cost of enzyme production for biomass conversion, and one which is cited heavily in the Biomass R&D Act is the enzymatic hydrolysis.

And we have partnered with two companies, with research actually going on in California, with (inaudible). And these efforts, most of them, have been four-plus year efforts.

We have invested over $35 million of federal funds into these companies just to solve, try to solve these problems.

And they have, of course, you know, company proprietary, that kind of thing. But they have publicly announced that they have reduced the cost of enzymes, at least in regard to ethanol, between 10 and 20 cents per gallon. So that's a significant increase from where they began.

And they did, yes, they did win a 2004 R&D 100 award, along with the National Renewable Energy Laboratory. So this has been, you know, kind of sets the stage. I think it more relates, perhaps to the agricultural residues than it does for the near-term stuff. But it does help, I think, diminish one of the problems that we faced in the past.

Okay, so we have partners. I'll try to go through these, because I know you have a lot to go through today. But, certainly one of the companies we're working with is Broin, and they've developed a mechanical fractionation process where they can separate the bran, the germ, the endosperm upfront.

And this makes them a lot more like a

corn (inaudible) in a way that could give them a much more product diversity, coproduct development. They can pull the stuff out of the (inaudible) grains and increase the protein content. So that also kind of helps from the animal feed's perspective. So this is one kind of an idea of a biorefinery.

A few different companies in their approach through here, and obviously there's no one biorefinery concept or approach that makes sense all the way. Although I think you will see some similarities in terms of products and things like that that help from the economics. And that's really what they're interested in.

We do have a fairly large contract with Archer Daniels Midland and National Corn Growers Association. And what they're doing, they're working with Pacific Northwest National Laboratory as one of their partners. And basically they're again separating the various components of corn fiber and converting the fuels and chemicals. They're taking glucose to ethanol out of those -- xylos to ethanol. They're taking arabinose and converting it to ethylene glycol, propylene glycol and glycerol. They're also taking the corn oil off out in the front and looking at it as a -- previous biodiesel (inaudible). So these are things that they're working on under this project.

And they should be at a goal next year to make the decision in terms of StageGate as to whether or not they're ready for the demonstration phase.

Cargill. Another major agriculture company. They're working with the Pacific Northwest National Laboratory and a company called Codexis, which is a subsidiary of Nexogen. And basically they're developing a catalyst for converting sugar streams to 3HP, which is a chemical that can be converted to malonic acid and acrylic acid from which a whole range of products can be produced. And so that's their approach. And Cargill works in the wet mill type of environment.

Nature Works, which until not too long ago you might have heard as Cargill Dow. And actually Dow Chemical pulled out of this joint venture. And so I think that the technical and financial risks, at least from their standpoint, were greater than they wanted to incur at this point in time.

But anyway, this company is developing a catalyst for converting sugars to lactic acid and ethanol. They have opened a plant really based on corn grain in Blair, Nebraska. But they're looking to move that to a corn fiber, both in the corn and -- at least in the corn as well as potentially pulling in other feedstocks, which I'll talk about here in just a second, the ag residue side.

Actually they're right here. They have a project, John Deere is involved from the equipment-manufacturing side. There are a number of matters accompanying (inaudible) and harvesting, handling, storage systems for cornstover.

What the goal here really is to try to pull cornstover in. And, of course, you know, that is one of the bugaboos of working with ag residues and forest residues is the cost of collection and that sort of thing.

They hope to pull it in for around $30 a ton, which would hopefully make them competitive. And so this is really a major project on sort of what they call feedstock interface part of the biorefinery.

DuPont, another major chemical company. What they're really trying to produce is one, increase ethanol, but also produce 1,2 propanediol. And that can be used for a number of products, one of them being fabrics. Cerone is one of their problem products. And they're looking at a biobased way of going to produce that.

They have a joint venture between DuPont and Tate & Lyle formed last year to produce PDO from wet mill stillage and get out glucose. So this would be, you know, another major project. And DuPont has gone fairly public with their pronouncements and what they hope to achieve in this area. So they seem to be a little more committed biorefinery partners I would say.

Abengoa, a bioenergy, is actually a Spanish based company. They bought High Plains, a number of U.S. operations. This is a recently developed picture insert of their pilot plant. They're looking primarily at increasing the level of ethanol that could be produced from a bushel of corn in a dry mill. They're looking at potentially -- cornstover; they would like to go from like 2.7 gallons per bushel up to 3.2. So that would be a fairly major improvement for them. So that's that project.

Well, this all sounds good, I guess, to a degree. Unfortunately, this is why I may not be coming back, I have to talk about the funding situation. And I guess one of the trends certainly that we have seen, it's kind of ironic that it kind of mirrors up with the passage of the Biomass R&D Act of 2000. Well, since then we've seen a threefold increase in what we call Congressional directed projects. And so we've actually gone from like I think 15 up to almost half in the current program.

And this has really impacted our ability to fund sort of on a discretionary level. And I know that a number of you may have, you know, been applying to solicitations and things. It impacts those. And there's a big question mark on this, obviously. We just don't at this kind of standpoint, certainly if this trend continues with the decline of the overall funding requests, we could be in some problems. So anyway, that's just sort of the situation.

There has been some reorganization, the Appropriations Committee in the biomass area, and within the renewable energy area that may -- I don't know whether it will help or hinder us, but I think change is coming there.

Okay, so in terms of the path forward, and you know, in our overall topic here of biorefineries. First of all, we are planning an international biorefinery workshop this summer, July 20th, 21st, in Washington. It's an invitational basis, but the people here who would like to attend such a conference, we're doing it primarily with the IEA countries and the EU in particular, group. But it's scheduled for this summer.

We're also in the middle of (inaudible), as well, involved with the biorefinery analysis that will help, I think, create a model and a context or how exactly the products will fit into the biorefinery, how important they are. What the split between products and fuels and electricity need to be. And would optimize things. Those kinds of evaluations.

As I said earlier, we are gearing up hopefully for a major solicitation in year 2008 at the demonstration scale. Our current focus, I think, as you've seen, is really on the dry --

residue pathways where we have partners established. Where we're working with existing industry to kind of expand it into the cellulosic world. We are -- the sugars platform part of the program. The technology for converting biomass to sugars through the (inaudible) hydrolysis. We're focusing on that and still continue to do that.

We did put out a product solicitation earlier this year, and it's gone through the technical merit review. It's still in the program committee. I think the question there will be, given all the rates and the budget, just how many projects we can support through that. Hopefully some.

And the thermochemical side, thermochemical conversion side, part of the push, the recent push really is to focus it on the lignin part of the biomass feedstock and try, since it's certainly not a part of the feedstock which lends itself to bioconversion using thermochemical -- for heat, power and products. Fuel products, in particular, I think, are what they're focusing on.

And the work on some of the near-term stuff I think is applicable to California in terms of say the enzyme development and those kind of things. In that certainly you have a large agricultural residue, it's here that I think this one makes sense to go.

We're looking to extend the forest sector where possible. And this would probably be in partnership with some of our USDA brethren.

Okay, just sort of a final -- my final Vugraph or slide. Basically it says a couple of things. In the green is sort of the DOE cost share of things. And this is looking kind of at the StageGate approach, moving from basic R&D across the spectrum to eventual operation.

And I think if you can see -- first of all you can see where the current biorefinery projects are; in sort of a proof of concept stage. That the A milestones that we were talking about earlier, commercial viable demonstration phase; that that's really a 2008 issues coming from.

But if you look at the, kind of a volume of the red compared to the volume of the green, I think you'll see that the private sector has to pick up more and more of this thing. And that that's really the burden of trying to move these things forward. As many, as well as I've been talking about today, -- intensive type of efforts.

A couple of things that we're looking at, although none of them really are in place at this point, they have to get over that hurdle on getting first commercial plants in various pathways to move forward, is one, loan guarantees program, which are, you know, I think that no matter what it would be in this area, would have to be fairly limited in terms of boundaries upon it, upon how much money and how they might do this.

The second is a look at kind of a risk mitigation pool as a way of helping to fund and get initial projects kind of going through that first year of operation where they go through mechanical, you know, mechanical completion to startup, get through that first year, which a lot of projects in the past have kind of stumbled at that stage. And moneys kind of run out. And so trying to create some kind of a risk mitigation pool may be helpful in terms of getting these things going.

So that's pretty much what I had to say. And thank you again.

(Applause.)

DR. JENKINS: Thank you, John. That was a very nice presentation. I think we've had two very nice presentations this morning. I learned quite a bit. And we see, I think, a lot of synergy between what's happening in the state and what's happening at the federal level. And hope to work with that over the coming years.

I am interested to find out how much of that billion tons of biomass is going to come from California. Hope at least 100 million there or something. So, -- I do have, if I can work this thing here, I may need my assistant back here. So, we'll try it.

We have two concurrent sessions coming up. We have a break right now if I'm correct. But we have two concurrent sessions. And as I mentioned before, if you've come in a little bit late, the biopower session will be in this room, and then the biofuels and bioproducts session will be in the adjacent room over here, the Coastal Room.

And we will take a 15-minute break for that. I won't remind you about cellphones because I had trouble turning my own off. We are doing a transcript of the conference today, the forum. We have a reporter here, Peter is here down in front.

We're going to allow lots of time for question and answers today, and I do want to make sure we have the speakers keeping on time for that, because we want to allow you to give us some feedback and hear what you have to say.

When you do have a question we'll have microphones in the room that you can come to. You can line up behind there and ask the questions until we run out of time for the day. And when you ask a question if you could give us a business card to the reporter so we know who you are, and please do identify you when you ask the question.

I think at this point we'll take the break. And there's some refreshments out there, and restrooms are off to the side here someplace. And we'll see you back in ten minutes.

(Brief recess.)

DR. JENKINS: -- PIER renewables program at the California Energy Commission. Known Val for a long time, and so Val's going to introduce the panel to you and make a few remarks. So, Val.

MR. TIANGCO: Good morning. Currently biomass accounts for 24 percent of the California net renewable system power, if I quote Bryan; and

20 percent of gross renewable system power.

Within the picture biomass were to maintain a 20 percent share, which is currently the share of biomass power in the state, then 660 megawatts would be added by 2017. An average of approximately 50 megawatt per year, assuming 85 percent mean capacity factor.

If the state accelerates the implementation of RPS to achieve 33 percent renewable electricity by 2020, capacity additions provide power would increase more rapidly to maintain 20 percent share, with annual addition ranging from 70 to 95 megawatt per year, and net accumulation added through 2020 of 1450 megawatts.

Under this assumption total biomass generating capacity would be 2400 megawatt by 2017.

Are we going to achieve this, or this are mainly speculative? Today we have five speakers that may shed some light on some of these potential megawatt addition in the state.

First speaker is Francis Lau. He is the Executive Director of the Gasification and Gas Processing Unit at GTI, Gas Technology Institute. His research, development and deployment programs aimed at the clean and efficient conversion of biomass, and coal to electricity, hydrogen and clean liquid fuels.

Without too much ado I would like to introduce Francis and he going to talk on the integrated gasification combined cycles and other advanced concepts for biomass power generation and its potential for development in California.

Each speaker will have 20 minutes to share their presentation, and then the question and answer will be at the end.

Thank you.

MR. LAU: Good morning. Thanks, Val, for the introduction. As Val said, I'm with the Gas Technology Institute and I'm going to talk to you today about some of the biomass-to-power technologies and going to cover a couple of them during my talk this morning.

For those of you who don't know who we are, the Gas Technology Institute, we are a not-for-profit, we are an independent company focused on research and development and deployment of technologies. We're located at an 18-acre site just outside of Chicago near the O'Hare Airport. So at this time I would like to invite anybody who flies through O'Hare to give us a call, and we'd be happy to show you our facility, which is about 15 minutes away. We have about 300 employees at our location.

The GTI service the energy industry all the way from production and wellhead, primarily the gas area, to transmission -- since we don't have a pointer you'll just have to look at the pictures that we show here -- through end use. And that includes combustion technologies; it includes industrial and both residential, commercial, industrial appliances. And it also includes gasification facility here, some chemical conversion of biomass, any kind of solid waste including coal and biomass. And we also have a group focus on developing fuel cells and microturbines.

Today I'm going to talk about, the topic of my talk is biomass gasification and power generation. So I'm going to focus on a couple of integrations between gasification and power.

The first one is the integrated gasification combined cycle utilizes the turbines technology. Second is the combined heat and power where we integrated the gasification system with engines, microturbines or fuel cells.

And last, technology integration is the integration of gasification with conventional boilers.

(Pause.)

MR. LAU: I thought the larger picture will be clearer to read from back in the room. Hope people in the back can see the fine print.

This is a typical IGCC configuration where we have a gasification system, followed by gas cleanup, heat recovery and then integration with a combined cycle, which is the integration of a gas turbine and a steam turbine.

Typically in the IGCC configuration the gasifier is operated under high pressure because the gas turbines require high pressure fuel input. The second integration schematic here is the integration of gasification with engines. And these can be run in terms of a gasifier can be run at low pressure because the engine inlet intake is typically lower pressures. So the gasifiers can integrate with low pressure gasification systems, as well.

Once again this is gasification with biomass producing the gas, followed by gas cleanup that could be including the tar cracking, particulate matter removal and other kinds of acid gases exist in the biomass prior to introduction to the gas engine for power generation.

In this particular configuration for combined heat and power, the waste heat from the engine is recovered to generate heat for district heating purposes.

As I mentioned, gasification can also be integrated with boiler applications, existing boilers typically. Integrate, if you want to utilize additional biomass fuel, we can gasify the fuel and the gas can then, depending on the boiler configuration, that dictates the level of cleanup that you will require from the fuel gas from the gasifier.

So in this case we show the particulate matter removal after cleaning, followed by gas particulate removal and then directly burn in the boiler. And in some cases, particulate matters can be injected into the boiler, as well, if a downstream systems can handle the dust.

The first three slides show typically, I'm showing with integration with fluidized bed type gasifiers. But something similar, if appropriate, can be different kind of a gasifier can be used. In this case we show a fixed bed type gasification system that is tightly integrated with a boiler for power generation purposes. So in this case I'm showing an updraft type gasifier integrated with a gas boiler and followed by a steam turbine for power generation.

Generically, about three types of gasification systems, fixed bed gasifiers that's shown on the left; a fluidized bed type gasifier in the middle; and an entrained flow gasifier on the right-hand side.

I'm going to focus today on talking about projects that we have related to the two types of gasifiers that GTI's involved in, fixed bed type gasifiers and fluidized bed gasifiers.

There are some operational differences between these types of gasifiers. Typically the fixed bed gasifier operate with material that are in larger size; material is basically moving in one direction in larger lumps, half-inch -- I mean two-inch sizes.

Fluidized bed require a smaller size material because the material is actually moving around in the bed. Typically in the range of half-inch size or smaller. And entrained flow gasifiers are even finer, and the sizes are getting .1 mm.

GTI has been developing gasification over the course of 30, 40 years, starting with coal. And in the early '80s we expanded our development of gasification systems for biomass fuels.

We've chosen to use, in this case, a dry feed. There are other people that can use slurry type feeding devices. But in our case we're looking at a set of lockhoppers for feeding, which is a dry feed mechanism that will allow us to feed into the pressurized vessel.

The middle unit denotes a fluidized bed, a fluidizing gas coming from the bottom which can be air or oxygen; can be combined with steam. And you can imagine, it's like a bubbling bed of boiling water.

In a fluidized bed operation typically you have fines that escapes the system, and downstream of the gasifier we would have a cyclone to recover the fines and reinject back into the gasifier. They're actually discharged from the bottom of the gasifier through another set of lockhoppers.

The other type of system I mentioned is the fixed bed gasifier. We're working with a company called Novel in Finland. They have an updraft gasifier that basically gas comes from the bottom. The material is fed typically from the top of the gasifier in lumps. And as it burns it moves down to the bottom of the gasification system.

And it's drawn out from the bottom. The gas comes out, is hot, and then it's loaded with contaminants. In this case for biomass has tars, oils, and other contaminant gases. Those are all the gases again has to be cleaned prior to being used.

GTI and our partner, Carbona, is involved in the development of a project in India. It's an IGCC project, so it does have the integration of a gasification system, followed by heat recovery, followed by particulate matter removal and acid gas removal, if needed.

And then the clean gas is burned in the gas turbine first, followed by steam turbines. The waste heat from the gas turbine is used to generate steam that is used to generate additional power from the process.

And we're developing this project in Andhra Pradesh in India. We've been using wood chips and woody biomass from plantations. The moisture content of those materials are roughly 20 percent. Heating value is about 9000 Btus per pound.

This particular plant is looking at processing about 200 tons per day of biomass. The total power production from this plant is expected to be about 12 megawatts. Two-thirds of that comes from gas turbine, and about a third comes from the steam turbine.

The overall efficiency for electric power production from fuel input is about 37 percent.

The second project that we're involved in is in Denmark. It's called Skive project. This particular project is a combined heat and power project. In this case, the gasifier process is biomass. The gas is cleaned prior to burning it in gas turbines to produce electricity. And then the waste heat from the -- I'm sorry, the gas turbine -- engines, the waste heat from the engines is used to produce heat for district heating.

This is about half the size of the project we have in India is about 110 tons per day, is using wood again; moisture content is lower, it's about 10 percent; heating value is a little higher, it's about 10,000 Btus. Again, the power generation from the three engines totals a little over 5 megawatts, and it produces about 11 megawatts of thermal energy for district heating.

Electrical efficiency is about 28 percent. The overall plant efficiency, combined heat and power, is about 80-plus percent.

As I mentioned, we're also working with a company called Novel that has a fixed bed gasifier. And they are building a plant that's about three times -- that produces about 1.8 megawatts of electric power, and 3.3 megawatts worth of thermal district heating.

(Laughter.)

MR. LAU: Yeah, I'm watching the clock and I actually have to go a little faster.

Three engines, 600 kilowatt each, so a total of 1.8. And then 3.3 megawatts of thermal electric, thermal heat.

I've gone through these already in terms of the power output. I'm going to move very quickly. We developing, GTI, Carbona and TSS Consultants are developing a project to manage forest residue. This is combined heat and power project. We're looking at about a 10 to 12 tons per day of forest residue to produce 600 kilowatts of electric power.

Efficiency estimated for this plant is about 28 percent, overall is about 80-plus percent combined heat and power. I forgot to mention it's about 1.8 megawatts of thermal heat.

This plant is going to be designed as a transportable unit. This is about a third of the size of the unit that I showed earlier from Novel in Finland. So using a single engine coupled with a gasifier. An appropriate gas cleanup systems, in this case tar crackers, filters and coolers, prior to burning the gas in the engine.

The Gas Technology Institute is also working on several other biomass projects. The one of the top left, we're working with the University of Minnesota on a project funded by Xcel Energy in Minnesota, to look at biomass to produce hydrogen. We're working on a two-ton-a-day biomass gasifier that's located in the

University campus.

Reading to the right you see a 60 ton downdraft gasifier. We're working with a company called Earth Resources, Inc., focusing on gasification of chicken litter. The gasifier that they using is used to generate electricity by boilers. But we're looking at extracting hydrogen from that gas, as well, burning gasifying chicken litter. That's a USDA-supported program with cofunding from ERI, Earth Resource, Inc.

And then we're also going to be looking at the developing new classification of tar cracking catalysts. As mentioned before, there's biomass gas contains a lot of tars and oils. And before you use it, it has to be cleaned properly. And that's a key where GTI is starting a new program in developing new catalysts for tars and oil crack reforming.

We've tested all kinds of biomass over the years. And what I want to talk to you about is, in the last few minutes remaining, is we just commissioned a state of the art gasification system at Chicago that's capable of processing, we call it a flexible system, so it's capable of processing different kinds of feedstocks. Coal, biomass, 20 to 40 tons a day system. It's capable of operating over 400 pounds pressure, air or oxygen operation.

As I said, it's commissioned the end of last year. This shows it's integrated. It has a feed -- a feed system, which again is a lockhopper system; followed by a gasifier; followed by cyclones that takes, recycles the dust. And recycle the dust from the cycling down into the gasifier.

We have ceramic filters that will take care of the dust prior to being flares. And you can see a flare. We are very, as I mentioned, very close to the airport. So the flare actually shouldn't look like this, because the pilots don't like to have flame underneath them. We're right at the end of the runway, by the way. The flare is actually at the bottom of the stack. What you see is not a flare, it's a reflection of the flame glowing reflection by the steam that is coming out from the stack.

I mentioned the gas cleanup, which is a very important aspect of biomass gasification. We're working with a project funded by the Department of Energy, led by Siemens Westinghouse.

We're working on what we call an ultraclean -- gas cleanup that would use contaminants down to the parts per billions level.

I mentioned earlier that we wanted these types of gases to be used, not only for power generation, but also for chemicals type production, or catalytic combustion if it is necessary, to lower the emissions.

So this particular project -- process, rather, will remove contaminants down to possible billions level, including sulfur, chloride, mercury and, of course, particulates. And again, we're using these ceramic-type filters for this particular process.

And when we talk about pass-through-ability we need very sophisticated type of instrumentation that can look for contaminants on that level to prove that we can, indeed, reduce the contaminants. But importantly, the analytical instruments are all well known and proven to work in those ranges. However, the key is to make sure that the sampling is correct and not contaminating or skewing the results by the sampling process, which might hide some of the contaminants.

So we are focusing a lot of our efforts

on developing a good sampling system so that we don't have interference or wrong information, if you will, read by the instruments.

We're doing other types of cleanup device developments, rather, multi-pollutant devices, both warm temperature and low temperatures. There's some low-temperature acid gas removal systems that we have technologies for the natural gas business that we're applying to the biogas.

Of course, we have a lot of laboratory-scale systems, as well. And I think I run over a little bit. This is again the picture of our pilot plant, and I encourage all of you to, when you stop by Chicago or fly buy, give us a call.

Thanks.

(Applause.)

MR. TIANGCO: That's an excellent presentation of GTI technologies. I know you've been doing a lot of things on gasification, your project in India and Skive. And also working a lot on cleaning up the gas and working on sophisticated analytical instrumentations. So we reserve the question and answer after all of the speakers have presented their project, particular talks.

The next speaker is Rick Bergman. He's a chemical engineer at Forest Products Laboratory for five years with primary focus on wood energy. And secondary focus on dry kilns, basically heating dry kilns.

His major function for the technology marketing unit is he's the technical lead on the small modular biopower system demonstration project. And basically he will share something on this development this morning.

And it involves the collaboration of local communities, government agencies and private industry. Without too much ado, I would like to give the floor to Rick. Take it away.

MR. BERGMAN: Thanks, Val. I want to thank the Committee, especially Bruce Goins for the opportunity to leave the cold of Wisconsin and to come to the green grass and the sunny skies of California.

I was looking for the place this morning, and I was looking for L Street. And I looked at my instructions and it said I Street. So, it took a little longer than I expected to get here. But I'm glad I'm here today.

Basically I'm going to be talking about, some people are probably more familiar with what I'm talking about today in terms of the BioMax project. It's been around for longer than I have in terms of wood gasification field. Forest Products got involved with it, Community Power Corporation. Actually Robb Walt is the President of Community Power Corporation, is here today. Want to raise your hand, Robb?

We got involved with them I guess in 2001. Because as the Forest Service we were looking for some ways of utilizing hazardous fuel from national forests.

So what we did was, it was part of a national fire plan objective, what we did was at the Forest Products Lab in Madison, Wisconsin, it's a national lab just like NREL is, National Renewable Energy Laboratory.

And we got involved with them, too, as well, in finding the technology that could utilize wood residue. And we got connected with Community Power Corporation. And basically it's been an ongoing relationship since then. And that happened in the early part of 2001.

And it's been very entertaining. I

learned a lot, and with gasification, I think Francis has given a pretty good background for what gasification, that I really don't have to go into any further, I don't think.

But basically I'd like to talk about is the BioMax 15, which this is a picture of. If you notice, this basically is going to be actually three major sections. We have the feeder bin and a feeder dryer and a day bin all right here.

This is where you can place in the wood chips or wood pellets, any kind of wood residue you want to put in there.

The next is actually the gas production module, and that's where Community Power Corporation has done a lot of work on. And that is the major intent of our project, was to gasify the wood into a wood gas, a producer gas, to be able to run an internal combustion engine, which is right here. And that's actually a generator set in there, too.

Off to the left you have the gasifier where the wood chips are dropped into. And that's actually heated to about 800 degrees Celsius. And that's where the wood is converted into a gas.

And then the gas is sent to a char bin

to knock out the heavies. And then goes through a heat exchange to cool gas down. And that gas is then drawn into a filter bed right here. And at that time it's about 100 degrees Celsius.

And coming out of that filter bed, the gas, itself, is, like Francis talked about, particulate of major concern, are reduced to sometimes less than 10 parts per million. And that makes it very efficient for an internal combustion engine operation. And the engine, itself, is pretty similar to a car engine.

I'd next like to talk about the sites that we're involved with in the Forest Service. This is actually the first site where the BioMax 15 was sited for us. It's at a high school basically. It's operating part of a greenhouse. There's more to the greenhouse now than was then. And actually it's all built up.

Right now, I talked to Philip Anderson; he's actually a teacher at the school. And basically what he has, he's basically the lead for the taking care of that unit at the school. What he has is high school students basically operate the unit when he's not around. But he also, he's the one that the students would contact in case there's any problems.

But the unit right now is for the one for Walden is actually located Community Power Corporation in Walden, I mean in Golden, in Colorado, getting some updates on it. But when it goes back, actually the unit's going to be capable of not only providing power for the greenhouse, but heat for the greenhouse, as well.

From what Philip was telling me, they put a water glycol heating system in the cement floor of the greenhouse to provide heat.

And the next slide is Glencoe, New Mexico. A wood shaving operation. This site has had occasional problems of maintaining staff at this site, which has been a continual issue. And it's noticed on the bottom, you can see that the site is actual idle; in the process of selecting a new site.

We're not sure where this unit's going to end up at. But it has run at this site several times, and I actually was there one time with Community Power Corporation. We actually trained some new people there, and actually I got trained there to operate the BioMax 15 on this site. For me it was very educational; I learned a lot. Also learned to know that the stresses that can be put on a small company in terms of trying to operate this because the unit is actually still precommercial.

Also, I guess I'll talk about the next site, the one in Zuni. This one we had particular problems in terms of getting it sited; in terms of environmental issues. The Zuni, actually part of the Zuni Tribe, Zuni Pueblo in western New Mexico; it's almost on the border of New Mexico and Arizona.

And there was an issue of what kind of emissions were coming out of the BioMax 15. And fortunately I brought a publication that was put out as a presentation, I think by Robb Walt and some people from Community Power Corporation, that does list the emissions from the unit. It does not -- it -- the CO, the NOx and the total THCs. It does not mention anything about particular tars coming out of the exhaust gas, which is not really much of a problem.

But for this unit that's been operating, both the Zuni and the Walden site have been operating for about a year, maybe two years now. I think the Zuni has operated for about a year, a little over a year. There's quite a bit of quality time on the unit.

The one coming next year, BioMax coming to Truckee, California. I'm not sure if everybody knows where that is, but it's north of Lake Tahoe. Scott Housey from McNeil Technology is the one who has helped to get that unit placed there, with a lot of funding from the California Energy Commission.

As with the whole project -- all the projects involved have a lot of emphasis, particularly the ones in northern California, from the California Energy Commission.

But the one in Truckee, what they're finding out is that it actually has some environmental concerns there, too, as well, from the town, the town council. And that's been an ongoing issue. So at this time it hasn't been installed.

And the plan for installation was to be in July of last year. But hopefully in the next couple months -- get the issues worked out.

And of course, my favorite is the BioMax 5, because it's actually located at the Forest Products Lab. And as you notice the notation here, you have 5, 15 and 50. That is what the unit is capable of producing on wood gas.

As you notice here, this unit is capable of putting out 5 kilowatts of power. And that's typically enough for a house, a rough house. If you only use either electricity for your oven, or for your hot water heater, this unit should be able to provide all the power you need.

And this unit actually runs off wood pellets. And what's different from the BioMax 5 and the 15 is that it's going to be operational 24/7. And what makes it unique is that they have a set of batteries right here that are powered up by the unit and charged when the unit's running. And when the unit shuts down, these batteries convert electricity back into the house or whatever you want to provide power to, until the batteries reach a certain point and the unit starts back up. Basically auto-ignites. And that's a pretty unique feature of this unit, the fact of being capable of auto-ignites. Then you don't have to restart it on your own, but automatically it restarts.

Of course, I talked to my wife about putting it at our house. Sue Levan wanted a unit, who is product manager for a technology marketing unit. She wanted it east of the Mississippi. So I said, well, our house is east of the Mississippi, but she thought that it would be better someplace else. Well, certainly my wife, she doesn't particularly like the idea of having wood in the house, but we have a garage out back; we can put it in there.

But here's where it's actually going to be sited at. And the -- BioMax 5, it's been actually at the laboratory for several months, as Robb knows. It's been sitting there in storage. We have -- it's being charged right now to maintain its batteries. And actually we're looking forward to actually getting the unit running hopefully by the end of this month, the start of next month.

You probably won't be able to see where she really planned on siting it. The unit, itself, is going to be in a temporary shelter on the right-hand side of the building. We're going to put an actually Menard shelter for it, a Menard shelter for it, basically, for right away until we can actually get it running.

But it's going to be providing just

electricity for the house, and maybe some heat for the garage. Because what this advanced house research center does actually monitoring the moisture traveling through the house. So some of the scientists are concerned about having issues us providing anything else for electricity.

So basically what we're going to do is we're going to provide dedicated electrical loads for the house from the unit. And hopefully we'll have the -- the permanent structure is going to be on the right-hand side, too, as well. It's going to be a little closer to the house. And it's going to be made of a -- structure, maybe out of black locust, which is found in Wisconsin.

Here's some numbers based on the expected fuel usage. The Biomax-5, the Biomax-15 I know pretty well, and what they're capable of using. As noticed here, the Biomax-15, a ten-hour shift. This is not expected to run 24/7. So this is just some numbers here. You basically use about 500 pounds per day roughly in wood chips if you use an air-dried chip.

Also from the Biomax-5 you typically are going to use a little bit more wood fuel for this because it's a little less efficient than the

Biomax-15.

But basically you're also using wood pellets in the Biomax-5. The idea for the Biomax-5 is hopefully use some sort of wood chip eventually, to provide fuel for the Biomax-5. But at the present time we're just using wood pellets because they're a lot easier to control within the gasifier.

Because one thing I should point out is that from the 5 to the 15 or 50, what's happening basically is the size of the gasifier, itself, is increasing in size. So it's a lot easier for a larger chip in the Biomax-50 to be controlled within the gasifier area.

At the 5 you actually have a tree, a char tree that goes through the center of the gasifier. You're talking about a six-inch area, six inches in diameter, you know, -- yeah, six inches in diameter gasifier, with the char tree goes through the center of that.

The difficulty of getting chips to go through that is that they're a little larger than the wood pellet. But wood pellets flow pretty well through the Biomax-5. So that's what we're going to do for doing the shakedown test of the

Biomax-5.

And the hope, once we get the Biomax-5 shakedown test done is to take it to -- send it to Arizona. And actually provide heat and power for some hogans. A set of three hogans out in Camaroon, Arizona.

And this is some -- what's interesting about the Biomax-50, I think, and this is the newest piece of unit that's being put out by Community Power Corporation and being funded by the California Energy Commission is that it's much more efficient than the 5 or the 15. Uses less actually wood fuel. At the same time it produces a better quality gas. And actually runs fairly well.

And here's just some numbers that I found out from operating the Biomax-50. I'm trying to remember when the unit was actually running, actually had a test run in Colorado at Community Power Corporation, I think two or three months ago. Here are some of the preliminary numbers that are coming out from the Biomax-50.

You notice in particular the overall system efficiency is 24 percent. First if 15 percent for the Biomax-15. So it's a huge jump in efficiency. So you're getting a lot more money for your -- bang for your buck, or something like that.

As noted here the Biomax-50 is the prototype is built. Be capable of grid interconnection because you will be able to provide power back to the grid to help pay for -- to help show that the DC units are cost effective, in that regard in providing electricity back to the grid.

It's going to be a 24/6 operation. I guess you use the word six to try to describe the fact that the unit's going to be down for at least one day, or one day every two weeks for maintenance and cleaning.

As you notice here, there's three sites selected for installation. There will actually be maybe more. I think there are actually more than the sites selected here, but the two here that are interesting in California, one is at the San Bernardino National Forest at the Big Bear Discovery Center.

And that one is going to be hopefully going in the third quarter of this year. But Mt. Shasta is actually -- at first initially it was going to be a 15 kilowatt unit there, is actually upgraded to a 50. And that's actually a lot of help in funding from the California Energy Commission to make that happen.

And that's going to be the first unit that's actually been tested that CPC is going to be installed there at Mt. Shasta at the Siskiyou Opportunity Center.

And system feedback on the operation of the unit. The hope is to make this thing operational by anybody in terms of just give you a little bit of training to have them use it. For now, though, the feedback from both the Zuni and the Walden units, it takes a little bit more expertise in operating them. They feel that we yet to be simplified in terms of operating the unit, be able to have people like farmers or people with ranches to be able to operate the unit.

The problem with the heat exchangers. I think that's an ongoing issue. That there's like four units that failed at the Walden unit. I think CPC has been very -- worked very hard and make a better design for the unit. But I'm not sure how this updates are going to help it. But something that we'll definitely keep abreast of.

I guess one thing that's been brought up by both people, I guess particularly one in Zuni, is the wood fuel issues. Oversize chips require removal or resizing. Smaller gas-fired, need for consistent size.

I think I'm running out of time here, so I'm going to try to go a little faster here. Like I mentioned earlier, high school students are actually operating the unit. And one point I asked with respect to this project was that it provide communities with the insight or the knowledge of renewable energy, in terms of what's the potential.

And I think the one in Walden is a great potential to show these students, particularly the ones that may go on to higher education, the capabilities of renewable energy. And actually get a hands-on information on that.

Some net metering economics. Some breakdowns of that. I think all these publications, all these presentations are CD available, I think. Someone is going to make available for you. So, some information you haven't found here, I think it's going to be available to you later.

What's important is for all the collaboratives to be flexible in the system. As I mentioned earlier, particularly emission data is going to be needed, particularly for the environmental concerns, for future sitings and make it a lot easier for newer sites to be -- newer units to be sited.

Prepare for setbacks in terms of timetables. Things don't always go as scheduled. What CPC's doing. Char is not listed as a hazardous waste. That was a big thing that CPC has done. Particularly reduction in tar particulate, and continue upgrading the air code.

The -- be capable of actually trying green wood chips from 50 percent down to the requirement is going to be needed. And also another feature of the Biomax-5 is using engine exhaust to preheat the unit for startup, for quicker changeover from propane to natural gas -- from propane to wood gas.

More improvements. Higher content of percent fines. The Biomax will be capable of producing 75 kilowatts of power, which is a 50 percent increase in the power out of the unit.

Biomax-50 actually has a better wood chip sorter. So the Biomax-50 is the new generation, I think, is going to be -- definitely is going to be a plus in terms of gas -- small scale wood gasification.

And that's it. Thank you.

(Applause.)

MR. TIANGCO: Thank you, Rick. That's a very good update on the development of Community Power Corporation's project. CPC's project is one of our success stories funded through the PIER renewables subject area. And they started developing the unit here in California and demonstrated the unit at Hooper Valley.

They also demonstrated the unit in the Philippines using coconut shells. And you didn't share about what happened to that unit, but it's good that it's moving along. Robb Walt here is doing his best to really deploy the technology through the R&D development, particularly on this technology.

Our next speaker going to talk on the landfill emerging technologies for landfill gas to energy. Rachel Goldstein is the Program Manager of the U.S. Environmental Protection Agency on landfill methane outreach program.

This is a voluntary program that encourages methane emissions reduction through the capture and beneficial use of landfill gas. Rachel's primary role is to manage the 16 territory states through corporate outreach activities.

And prior to joining the EPA Rachel spent 11 years in environmental safety and health field. And Rachel is on the board of directors for the Women's Council on Energy and Environment.

Rachel, take it away.

MS. GOLDSTEIN: As soon as we get my presentation up here.

(Pause.)

MS. GOLDSTEIN: I have to say like my predecessor before me I'm quite happy to be in California, as yesterday it was snowing in Washington, D.C. So, it's much nicer to be here in warmer climes, certainly.

Well, for today, this presentation, kind of like a tasting menu at a restaurant. I'm going to go through a little bit of a sample of everything that's out there that we see in terms of landfill gas technology. From the direct use in the electric, which tend to be a little more of our bread and butter of projects. But also for the combined heat and power, microturbines, vehicle fuels as some of the emerging technologies.

For those of you who are not familiar with the EPA's landfill methane outreach program, we are a voluntary program, meaning I have absolutely no regulatory authority whatsoever. And we create alliances among states, energy users, energy providers, the landfill gas industry and various communities in order to provide -- to do beneficial landfill gas energy projects.

The primary goal of our program actually is methane reductions. And we are in the climate change division at the EPA. And for those who are familiar with methane being a global warming gas, that's actually much more potent than CO2.

Some of you may be wondering why use landfill gas. Well, in a quick overview of landfill gas 101, all the trash that we throw out on a daily basis sits in a big hole in the ground and under anaerobic conditions decomposes into landfill gas.

Landfill gas is about half methane, half carbon dioxide, and a small percentage of what we call nonmethane organic compounds or some folks know them as VOCs, or affectionately known as the nasties in landfill gas.

However, with the methane content it is a local available fuel source. It's relatively easy to capture and use. And while our program has been around for ten years, some of the earliest natural gas projects started in the late '70s or early '80s. So there is a pretty proven track record of capture and use.

It is a source of renewable energy. California's one of 18 states that now has a renewable portfolio standard. And all those states do include landfill gas as a renewable energy.

It is constant, and so for the utilities utilizing it, they like it because it's a baseload fuel. The landfill gas is generated 24/7 and can be utilized up to 90 percent or better of the time, making it great for baseload.

Without capturing and combustion either in a flare or in an energy project, this is a source of energy that would otherwise be wasted. I have plenty of people who come up to me asking me about various flares that they see. And they just see the gas burning and think, oh, this could be used for something much better than just flaring the gas.

And certainly using the gas also helps the environment locally in terms of local pollutants from the nonmethane organic compounds, as well as combatting global climate change regarding the emissions of methane.

Some of the uses I'm going to talk about today involve direct use, combined heat and power, electricity production and some of the alternative fuels that are coming out there.

From a direct use standpoint we're looking most of our projects are in industrial boiler operation. There are some direct thermal, and then some of the more innovative projects that allow utilization of smaller landfills include greenhouses, infrared heaters, pottery kilns and leachate evaporation, which would be used onsite at the landfill.

(inaudible) is you're going to build a pipeline out from the landfill to the end user. Right now there are about 100 projects that are on the direct use side in the United States. And the pipelines range anywhere from half a mile to now

23 miles. Last year we put on the longest pipeline for Honeywell in Hopewell, Virginia. And several years ago a 23-mile pipeline was really just unheard of.

But on average most of these pipelines are about five to ten miles long. And the gas is used onsite at the end user.

Some of the advantages of this include that it can be used in industrial process for electricity generation or in a steam turbine. It is a pretty mature technology that we do have a good track record of this. And certainly for the end user, through utilizing landfill gas, now with the rising cost of other fuels, some companies are saving hundreds of thousands of dollars a year in their energy costs.

You do however need a larger landfill, particularly for something like a 23-mile pipeline; from a pure physics standpoint you need a large flow of gas in order to move it down that size pipeline.

The end use facility may require retrofits on their boiler. Landfill gas is a medium Btu fuel versus natural gas which is a high Btu fuel. And a retrofit may cost $50,000. And, again, people are now looking at that as not so bad a cost compared to $6 or $7 mmBtu of natural gas. And you may need high pressure for steam turbine use.

Again, we're looking at larger landfills, we're talking about sizes of anywhere from three- to five-million tons of waste in place. And the cost of landfill gas, depending on a number of factors, can range from $1.50 to $3.50 per mmBtu. Again, if you need boiler retrofits, if you have a third party with the gas rights, size of the pipeline.

On the direct thermal side, in terms of heat applications, you have something very similar. Again, simple technology; cost effective. And some of the disadvantages which go to any direct use project, really. Where you might have right-of-way issues in terms of how far, how many different properties you're going to have to traverse. And the local terrain may not be conducive to pipeline installation. In which case your most direct use, as the crow flies, may not necessarily be the practical pipeline use.

Wide variety of landfill sizes. And similar costs as we saw on the traditional direct use side.

On the combined heat and power we're now starting to see or some folks noticed cogeneration. Some of these projects taking advantage of the waste heat. We're seeing it on the large industrial application as well as on the smaller microturbine applications.

On the large side, again your overall energy recovery, your efficiency of the project goes up tremendously. It's pretty flexible. There are specialized CHP systems out there. One of our I guess premiere projects that has this is BMW's facility in South Carolina. Actually out there there may still be some handouts regarding BMW's sustainability report talking about it.

Then have a ten-mile pipeline where they're also capturing the waste heat in order to heat the water in the plant.

There are, however, some additional upfront costs with combined heat and power that may discourage a few folks upfront. Again, you can see on a per-kilowatt range that you have a 1200 to 2000 installed capacity versus a standard engine rate which might be about 1100.

On the small size for smaller engines or microturbines, we do have a high school in Antioch, Illinois that put one of these projects on. And is using the combined heat and power to actually heat the high school pool. So, again, this is a much smaller landfill. It used to be a Superfund site, but managed with microturbines and combined heat and power to make a project work. And one that we actually gave an award to last year.

Some other advantages with the microturbines that you also have lower emissions, lower noise. A disadvantage, however, is that you have to do some additional cleaning of the gas. The microturbines, when they first came on the scene, were not really retrofit in any way to deal with landfill gas versus natural gas. And some of those, as we call them nasties, are not so nice to the engine. We had some problems early on with them. So there's some additional cost when you have to remove the siloxanes. And you can see that in the capital costs here, that it does increase your costs.

Another example here is electricity generation which really is a primary use of landfill gas. Of the 378 projects online across the country about 65 percent of those are electricity generation.

You can see in the U.S. over 1000 megawatts of capacity from over 200 projects. The electricity is generally sold to a utility, a cooperative, possibly a nearby customer. And, again, we're seeing an increase in interest generally on the coast where there are renewable portfolio standards that include landfill gas.

The average project is about 3 megawatts, not super-huge, but we do have a range of 500 kilowatts to 50 megawatts. The 50 megawatt project is here in California, outside of Los Angeles at the Puente Hills facility. And, yes, for the fact that you can get a megawatt out of about a million tons of trash, it's a very large landfill.

The technologies we're seeing are generally internal combustion engines, which is what we'll see most often. Turbines, microturbines and then some other engines, the Stirling engine and organic Rankine cycle.

For the IC engine generally your advantages are low costs, high efficiency and reliability. It's pretty common out there and that's where really the industry has the largest track record.

However, certainly one of the challenges in California is that if you're not using a lean burn engine, you do have high NOx emissions. And with a lot of nonattainment areas that has proved to be a little challenging in the State of California.

But you also have particulate matter build up in the engine, and possible corrosion of catalysts, again due to some of the nasties in the gas.

The IC engines are generally used for projects about 1 to 3 megawatt size. Costs 1100 to 1300 per kilowatt. The players out there, probably names that are familiar to most, Cat, Jenbacho, Wakesha and Deutz.

On the turbine side these are generally used for larger projects. Again we'll see these have lower NOx emissions, so a little easier to permit. Lower O&M costs. From the disadvantage side they are a little more inefficient at a partial load and they also have high parasitic loads because of the gas compression requirements.

And you can see here, we're looking at

one of ten megawatts, capital costs of 1200 to 1700.

The microturbines, as I mentioned before, had a few setbacks early on, but are certainly coming back quite a bit, particularly here in California, as there are some incentive programs. They make microturbines a little more cost effective.

Some of the advantages are the low emissions, light weight, small size. They're actually very scalable. As I mentioned, that project in Antioch, Illinois, the high school right now has 12 microturbines. And you can kind of bring them up and down in terms of matching the gas flow at a particular landfill, since the gas does typically come in almost what you will see as a Bell Curve. Somewhere down the line, as you go on the descending end of the curve you can remove microturbines so it does help with the scalability of a project.

Again, it's a little less proven. There were some hiccoughs early on, but the projects online now seem to be doing better.

Working on, as you can see, much smaller sized projects as opposed to the IC engines and the turbines. But you can also see some higher costs that go with it.

From the emerging technology side we're looking at Stirling external combustion engines. Again, we're looking at lower emissions, scalable and fewer moving parts. And when I talk about a limited track record of performance, we're aware of two projects right now that have these engines. One that's been online for about two years in Michigan, and one that just came online in the past year in Texas. So, as compared to some of the other technologies you can see our data points are rather small for this one.

But generally, again, we're looking at some of the smaller technologies. And our capital costs, we don't have a great deal of information based on limited projects that are out there.

The others are organic Rankine cycle, which is generally used more on the combined heat and power side. Essentially it's going to be waste heat powered. Again, it's something that we're seeing in demonstration project only at this point.

On the alternate fuel side we're looking at high Btu upgrades and vehicle fuels for LNG or

CNG. As I mentioned before, landfill gas is a median Btu fuel, so because it's half methane it has half the heating value of natural gas.

However there are some folks looking at putting the landfill gas into the natural gas pipelines as a high Btu fuel. And what that means essentially is that you have to scrub out pretty much everything else that's not methane. So you're going to need a 97 to 99 percent methane rather than the 50 percent. So there are technologies out there that can help scrub out the other parts of the gas. But it is a bit expensive.

However, some of the natural gas companies are, through their industry associations, are coming to us in terms of looking at that as a possible option. You do have the reduction in use of fossil fuels, as well as local pollution.

One of the big challenges to these projects, particularly early on, is that they're expensive. And when natural gas was abundant and cheap, it was not something that went over very well. And in addition, the natural gas companies, there is no pipeline standard for landfill gas.

And it is really set on a company-by-company basis, depending on who is managing the pipeline. So, one company may set a certain amount of percentage of methane, and another company might set something else. It makes that even possibly high from a cost effective standpoint.

Some of the bigger concerns really involve oxygen into the pipeline. And again, we had a couple projects a few years ago that shut down. However, we are seeing a resurgence and we had a few that went online this year, and we'll see if they can get to a couple of years.

It's economical really for large scale only. You're talking about 3 to 4 million for your costs for 2000 cubic feet per minute system. You can see the O&M costs on an mmBtu basis.

I'm also going to talk about in terms of technologies that are out there are vehicle fuel applications, which, to me, having seen one of them in person on the east coast, I think appeals to kind of the inner geek in me. I think they're kind of neat projects.

One is compressed landfill gas which is actually here also at the Puente Hills facility; the one that has the very large electricity project. Where they are taking a portion of the landfill gas and using it for vehicle fuels for county vehicles.

On the LNG side we're seeing one in Billington County, New Jersey, where Waste Management, one of the largest, you know, trash companies that are out there, essentially what they have done is they have worked with Mack Truck to retrofit two trash trucks to run on methane gas from the landfill. So they're testing that out to see how that's going to work, which makes a nice circular process where they're dropping off the trash and then fueling their vehicles to pick up more trash from the landfill gas.

It's in demonstration stage only, and certainly these vehicles do have a limited radius at the time being because they do have to come back to the landfill in order to refuel. But they do strip out the CO_2; they take out the NMOCs; and they put that part back to the flow for combustion. And then take the methane and fuel the trucks.

On the biodiesel side it's more of a synergy approach where we're not necessarily making biodiesel from the landfill gas. But we're looking to fuel the facilities that make the biodiesel using landfill gas.

Again, some of the advantages out there, for the vehicle fuels or the LNG, CNG, price can be lower than diesel fuels, reduction in fossil fuel and its associated pollution. Very small percentage of alternative fuel vehicles out there, as well as fueling stations for them, so making them somewhat impractical outside of demonstration stages right now.

Vehicle conversion costs are somewhat high. And, again we have the limited track record of performance. Some of the data that we have is really little more firm; some of the industry associations in terms of a retrofit of a vehicle from a diesel to a natural gas engine, and some of the fueling station costs.

In California we see so far that we have 80 landfill gas to energy projects that are operational, with another five under construction. So we have about 280 megawatts of energy being produced from landfill gas currently in the State of California.

From our database we see there are another 43 candidate landfills around the state.

And our definition of a candidate landfill is really something that we think could economically support a project.

And for those who are interested in what those 43 are, we do actually have a sheet out there listing what they are and what we think the potential megawatt capability from each of those sites are.

Some of which are probably most suited towards microturbines because of some of the incentives from the state. Actually most of the microturbine projects out there are here in California. There are 11 operational projects here using over 50 microturbine units and generating 2700 kilowatts of power.

So in summary we think there are many ways to beneficially utilize the landfill gas. And it's not just the traditional electricity projects that we've been working on for many years.

The available -- technologies, you know, there's certainly, they exist for low and high volumes. Maybe some of the smaller landfills that might not have been a feasible project many years ago now look a little bit different in terms of their project's economics.

However, you will need to look at these projects really very much on a case-by-case basis. Certainly makes the industry a lot of very challenging and a lot of fun, but it does frustrate people who want to have a cookie-cutter approach to all the projects, because we haven't seen one that works yet.

And, again, some of the selection considerations. Environmental performance of the engines; the liability; you know, assumptions based on modeling of the gas and what's available; permitting issues; and of course, everyone's favorite of costs.

Okay, thank you very much.

(Applause.)

MR. TIANGCO: Thank you very much. That's indeed a landfill gas 101 course. Yeah. The only difference is instead of you giving us a quiz at the end, we will give you the quiz instead. So, all of us will ask questions after the last two presenters.

The next speaker will be Ruth MacDougall. And she is with the Sacramento Municipal Utility District. And she will share something of the power generation from dairy manure and other wastes. The role of municipal utility in this power generation from dairy manure and other wastes.

Ruth is a project manager in the advanced renewables and distributed generation technologies program at SMUD. And is responsible for the SMUD's biomass program.

Without too much ado I would like to give you the floor.

MS. MacDOUGALL: Thank you.

MR. TIANGCO: Thank you.

(Pause.)

MS. MacDOUGALL: Good morning; it's a pleasure to be here. My name is Ruth MacDougall and I work for SMUD. It's the local municipal utility district. I'll talk about dairy manure and other waste residues for biomass energy.

SMUD, just like the investor-owned utilities, we have our own renewable portfolio standard. Ours is to acquire 20 percent renewables by 2011. And we expect by 2006 to have about 20 percent of our renewable energy from biomass.

We have always been a leader in

renewable energy. We have a renown solar program that has installed ten megawatts of photovoltaics. About 50 percent of these are utility scale, and then quite a lot is distributed energy connected at customer sites, businesses and residences; 900 systems, in fact.

We also have cogeneration at three plants, Campbell Soup, Procter and Gamble, and one of our plants, Carson Energy uses biogas from the wastewater treatment plant to make ice.

We are acquiring renewable energy through two processes, one is RFOs or RFP for purchase power. And recent RFO we received 15 conventional biomass proposals and four emerging proposals, renewable proposals. We're evaluating those and negotiating contracts.

But in addition, though, we want to develop local biomass resources. We see many benefits. It's relatively low cost energy, 5 to 9 cents per kilowatt hour; that's relative to say photovoltaics or some other.

It has a potential to reduce air emissions and groundwater contamination in our community. Fairly mature technologies. And, of course, a sustainable fuel supply within our own community. And it serves other waste disposal purposes. So it's very good for a customer-oriented utility.

One of the first things we wanted to know is where is this fuel in Sacramento and the adjoining counties, so we've launched a fuels inventory starting out with state and federal government databases; plus the UC Davis information. And then also surveying waste generators, themselves.

We're looking for various waste types and quantities, and exploring the existing waste disposal methods, costs of collection and transport, and seeing if there's interest in alternative waste disposal or energy generation.

We're combining that with technology assessments done by UC Davis and other consultants. And determining, you know, what's really viable and sustainable in Sacramento.

So, our inventory has gotten some results so far, and we're still working on, you know, the urban wood waste and agricultural wood wastes. And additional conversion technologies. So far we've explored anaerobic digestion, for instance, and the landfill gas. So we've got quite a bit of potential.

We find that there's several technical challenges that need resolved, and so we have a lot of R&D efforts, as well. One of them is, for instance, engine emissions; you know, trying to reach compliance with small distributed generation technologies. And then just techniques for managing the waste.

We've been working on a program with the California Energy Commission, Public Interest Energy Research program. And we have several biomass projects there. And we continue to develop proposals for other funding agencies.

One of which is the Yolo County, one of our CEC-funded projects is the Yolo County anaerobic bioreactor landfill. And t his is a full-scale landfill, for instance, that demonstrates accelerate anaerobic digestion by recirculating the leachate, or the water in the landfill.

And one of the results, it's extensively monitored, but one of the results is that it creates all this landfill gas early on, like in the first six years, rather than taking 30, 50 years to create landfill. And this makes for a much more economic way of capturing the bioenergy from the site.

Another program is to demonstrate the near-term technologies. Demonstration and deployment increases familiarity with the technology and spurs investment by the private sector.

And to help out there we've provided the incentives for local projects to overcome the economic challenges. And also developed a biomass net metering rate for biomass, for facilities under one megawatt. This is actually going to be voted on as part of our rate proceeding in the next couple of days. So hopefully this will pass.

We're developing a pilot dairy manure digester program. And last year the USDA rural development offered 25 percent funding for renewable energy projects. And Sacramento has 43 dairies, so we offered to actually the top 11 dairies, the 13 percent funding to match the USDA funding.

And five dairies submitted proposals under the program. And three of them were awarded, one in Elk Grove and two in Galt. So we expect the completion of these dairy digesters to be in late 2005. They're in the process of getting under contract.

Here's where the dairies are located in Sacramento. They're really kind of south county near Galt and Elk Grove. And you can see the stars are our star dairies, and they're the ones who are developing digesters right now.

So we've focused on the top, you know, anything above 400 cows because it's really where sort of the economic cutoff is. I don't know if you all know, but each cow produces 120 -- actually a milk cow produces 120 pounds of manure each day. And this manure has to be managed by the dairy. So there are various methods, either the scrape method or the flush method.

And the digester type depends on the manure management method and the resulting percent of solids. The scrape management method is basically the dry manure is scraped up by a tractor. This is actually more the east coast or mid-country -- midwest. But it results in 11 to 14 percent solids and so that can go into a plug/flow digester. And here's an example of that.

In California we have a, I guess ample

water and they prefer the flush manure management where they use a large quantity of water to flush the manure down stalls, flushing feed lane, and run it basically to a lagoon. And the digester is a covered lagoon. It basically puts a plastic bag over this digester; it's usually 1.5 percent solids. And generating methane is captured under that cover.

Sort of a compromise between the two is the complete mix digester. And this is when you have a combination of scrape and flush and your solids are about 3 to 11 percent levels. So this is a sample of a digester in New York done by RCM Digesters. I've liberally used their photos in the presentation.

And, of course, in all cases the energy is collected and generated usually in an IC engine -- ICE engine, and here's a sample of one that's in Lodi, California, not too far from here.

Our three dairies, I have four here because our three dairies were planned for ambient temperature covered lagoon digesters, and the Elk Grove dairy is considering a heated complete mix covered lagoon digester. And also the addition of food waste.

And this points out how the, you know, the top number, 113 kilowatts, can be increased by the addition of food wastes and also by heating, and you know, a slightly different style of digester.

But all told, our three dairies are expected to provide 355 kilowatts and about 2800 megawatt hours of electricity.

We've analyzed the payback and costs for the digesters. And the goal of our incentive is to bring things down to about a five-year payback. Originally -- don't know if this pointer works -- but you can see that estimated payback without incentives was about, you know, eight to actually 13 years. But with the incentives we were able to bring the average down to about five years.

And, of course, the adding food waste, let's see -- by adding food waste you can really get some economy in the digester because you're increasing the, you know, the volatile solids.

You might note here that we're analyzing the cost based on 1000 pound animal units. I think the industry sort of lacks some standardization. A cow is not always just a cow, you know. They've got calves and heifers and milk cows and dry cows and everything. So if you normalize it to 1000 pound animal units, then we can kind of compare, you know, the costs and the energy generation potential.

One of -- there's many environmental benefits from the dairy manure digesters, and one is reduction of the VOCs and greenhouse gases. According to our local AQMD title 5 emission estimates, the VOCs from our three dairies will reduce, you know, 21,000 pounds per year of VOCs.

And then the methane reduction is significant, too. It's 910 tons per year of methane that's going to be captured and burned in the internal combustion engine. Because it's, you know, more potent than CO -- a more potent greenhouse gas, that's equivalent to 20,000 tons per year of CO_2 equivalent.

This is also, you know, in addition to the odor reduction and this is something we think will make our dairies better neighbors and help our community.

SMUD plans to continue our dairy digester program this year. USDA, I think, is coming out with another round of funding. And, you know, if we were to capture all 15 of our top dairies it would be 850 kilowatts potential, or 7500 megawatt hours.

So as I mentioned, there's some technical challenges, and we're doing some research and development, or planning on it, on research and development to answer some of these problems.

One is the NOx output from small engines. So we want to test a Deutz low NOx engine side by side with a Caterpillar and do emission testing. And see if we can get down to our 50 parts per million, which is going to be a very tough battle.

Also we're looking at feasibility community digester concepts. You can see that in the Elk Grove area we have a little cluster of dairies all within, you know, half a mile of each other. So we're going to compare with costs of either moving the manure or moving the biogas, just piping it to a central generator. And develop the business model that's necessary for the dairies to cooperate on a venture like this.

And, you know, we may find in comparing emissions of one large clean gen set to a number of small gen sets, we'll be ahead. But this is yet to be seen.

And another project that is proposed is to model this co-digestion of food and manure so that we can do this without risk and, you know, really optimize the food addition to a digester. And the project will develop the infrastructure with various partners, the dairy, waste hauler and also the City of Sacramento, which is embarking on developing a plan for food collection at commercial food waste generators downtown.

On to another program. We're very interested in other potential waste residues in Sacramento. Green waste, for instance. The City of Sacramento has been often called the city of trees, and now I know why. It has a million trees; it results in about 35 percent of the waste stream. And it's actually the second highest number of trees per capita, second only to Paris, France.

So, the City generates, actually we've counted about 200 -- City and County generates about 270,000 tons of green waste per year. And the Sacramento Waste Authority, which consists of Sacramento County, City of Sacramento and City of Citrus Heights, is searching for a composting site. They want to do local composting. Currently it's trucked about 80 miles away. And to reduce transportation costs and emissions they would like to do it locally; also being local control and jobs.

Well, we think that anaerobic digestion is just another way of industrial composting in a sense. And it's a very viable alternative. As well as producing electricity, you know. It can be easier to site. You don't need to -- it's far less odor, little or no odor. And it takes a smaller space requirement. And you can actually have this closer in town in a more industrial setting.

And it has, you know, SMUD can be a customer for either the electricity generated or for the biogas that can be piped to one of our cogeneration plants, for instance.

The benefits are it can remove the ammonia and volatile organic compounds that normally would be associated with aerobic composting. South Coast AQMD proposed a rule, 1133, which identified the emission level for ammonia. And also for VOCs.

There are 260,000 tons per year would

create 111 tons of ammonia, or 500 tons per year of VOCs if it was composted aerobically. So we think anaerobic digestion would be a better option.

The rub is the economics of it. And so we've hired a firm, RIS International, Inc., and (indiscernible) Consulting, to evaluate the economic feasibility. They collected and evaluated data on a number of AD, anaerobic digestion technologies, and identified the capital and operating costs that would be associated, and the potential for green power.

Here's some examples of what these systems look like. They're usually a large tank; they can come in a single stage or two stage. The first one is Dranco System out of Europe. And Valorga is another popular system over there. And the third one is onsite power; that's a two-stage system, and that's right out here at UC Davis.

The anaerobic digestion is a very mature technology. Of course, it's been going on for years at wastewater treatment plants and food processing operations. But in Europe and Japan it's really expanded in the last ten years. There's now 74 full-scale anaerobic digestion facilities. It takes care of about 12 percent of the municipal solid waste in Europe.

However, there's none in the U.S. And we'd like to change that. There are large scale, 17 of those systems have capacities over 50,000 tons. And then 57 with less than 50,000 tons. And there's more being planned and constructed in Europe.

We've isolated, you know, what are the best technologies for green waste. And, you know, as I said there's single-stage or two-stage technologies. They both have advantages and disadvantages. And the wet technologies are more for food waste. Dry technologies are actually better for green waste.

And so we've looked at a list of three or four technologies, and identified the costs. Bottomline is our feasibility study results show that our resources of green waste can produce about 6 megawatts and 50,000 megawatt hours per year in Sacramento.

There are higher tipping fees associated with them, somewhere in the 40s, as opposed to, you know, aerobic composting with 25. But there are opportunities to reduce these costs, and those should be pursued.

For instance, co-location with other facilities like a material recycling facility or a landfill can make dual use of the personnel and the equipment such as tipping -- and scales. And co-digestion of food wastes helps the economics, as well as biogas production.

There may need to be some compromise between increasing some tip fees and finding other economies in the waste collection costs. And, of course, you know, to get a demonstration going here where we can kick the tires and test the emissions and it would take some capital grants from funding agencies. And I think that it's a worthwhile thing to collaborate on and partner.

Just in summary, SMUD's biomass strategy so far has been to build on the success of our renewable energy program. And develop a biomass program. And we started out our first projects with dairy manure digesters and green waste, designed to get some early success with a very noncontroversial mature technology of anaerobic digestion. And this is already eligible for diversion credits.

But we plan in the future to incorporate other conversion technologies such as gasification and acquire sustainable renewable energy to provide benefits to our local customers.

Thank you very much.

(Applause.)

MR. TIANGCO: Thank you, Ruth. That's an excellent presentation on the SMUD's program, the conception of the biomass program within SMUD.

Our last speaker, but not the least, is Tony Goncalves. Tony is working with California Energy Commission and he manages the existing renewables facilities program. He has been managing this program since the inception in 1998.

He's also currently working on the (indiscernible) program. Tony will talk on the results of the renewable energy and agricultural biomass-to-energy programs in California.

Tony.

MR. GONCALVES: Thank you.

(Pause.)

MR. GONCALVES: All right. Thank you, Val. I see we're starting to run a little short, so I'll try to move a little quicker through some of my slides.

My presentation today I will cover sort

of the results of the agricultural biomass-to-energy program, at least the part the Energy Commission ran for one year.

I'll quickly cover the overall results of the renewable energy program. And then I will cover some of the biomass-specific program areas and some of the results and opportunities for biomass facilities.

The ag bio program was enacted through SB-704; and that was adopted in September of 2003. It provided 6 million in funding, and that funding was allocated from the renewable energy program. It was a one-year program. And as you can see, it was adopted in September. However, the eligible funding period was from July of '03 through June, already three months into the eligible period.

The legislation did not take effect until January of '04. And it took the Commission another month or so to actually get the guidelines in place. This was already seven months into the qualifying period. With the history of the previous biomass -- or ag/bio program run out of Trade and Commerce and with the fact that money had been reduced each of the three years of that program, there was definitely some uncertainty amongst the potential participants on whether this funding would actually be adopted or not.

The program provided for $10 per dry ton, per wet ton of qualified agricultural biomass; and qualified agricultural biomass were fuels that had traditionally been open field burned, primarily in the Central Valley.

And unlike the previous program, through Trade and Commerce, there was some provisions that required facilities to increase the amount of fuel purchases of over a historical five-year period.

In part because of the increased requirements and the fact that the legislation and the final guidelines were not adopted until well into the funding period, I believe the amount of participants were limited. We did have nine participants. Given the $6 million that was available, the nine participants were more than enough to use all the money available.

We did provide approximately 5 million of those 6 million were paid out for July through December purchases. We did have a requirement to make payments for that time period by March. And therefore, divided the requirement, the increased requirement of purchases into two blocks. Having to look at only the July through December period in order to make those payments.

Because of that there was one participant who decided not to participate in the second six months of the program, knowing that they would not be able to meet the requirements.

We had only $1 million left for that second six months. And, of course, that didn't really go very far. As this graph illustrates, conveniently I have tons and total incentives matching up across the board, but you can see that mid-February we basically ran out of money.

We provided funding for the full 600,000 tons, even with the reduction of one facility for the second six months, and possibly a couple other facilities that most likely could have participated if there had been sufficient amount of time to gear up for the program.

There were 928,000 tons of QAB submitted to the program. Clearly the program that if it was to continue on a longer term looks like the 10-plus million is something that would be required in order to fully fund a program like this.

It is definitely a worthwhile program.

However, from the one year that we had this, it is very difficult to decide and determine whether it was truly successful or not. This program would need to be something that would have a longer term, a specified funding source so that facilities would be able to essentially gear up and provide a plan over a number of years. I believe we'd get significant benefits in the reduction or improvement in air quality from a program that had a long-term funding source and was allowed ample time for the facilities to gear up.

Now I'll quickly cover the renewable energy program, and then I'll cover those specific areas that can benefit biomass. The main objectives of this program are to maximize the market incentives, insure the diversity and the benefits of renewables in California, while trying to develop a self-sustained renewable market.

There is also a segment to develop market-based new and emerging technologies. And the goal of especially the emerging and the new is for these to be self sufficient at some point in the future, and not require any incentives from the Commission.

Here's a quick breakdown of the funding from 2002 to 2006. You can see the majority of the funds go to the new renewables, which is basically going to fund supplemental energy payments through the RPS. There is a large amount, 27 percent, for the emerging renewables, which has primarily been focused on PV systems on residential and small businesses.

Twenty percent to the existing, which is where the majority of the funding for biomass facilities comes from, primarily the tier 1, where 15 percent of the funds come from.

And then there's a consumer education portion where half of that is going towards developing a regional tracking system for the RPS.

Quickly, some of the achievements of the programs. The emerging program, we've got over 12,000 systems installed; primarily PVs. There are some small wind and a handful of fuel cells, although you can probably count them on well less than a hand.

There are more than 48 megawatts of installed distributed generation from this program. The consumer education program has had a number of statewide awareness campaigns; some smaller outreach and demonstration projects. And going forward, 1 percent of the funds available to that will be for the development and operation of the tracking system to verify the RPS.

The new renewables program has had a few biomass facilities in there. There were 69 projects that received awards. Currently there are 45 online, accounting for about 128 megawatts. Most of those are new projects; some of them are repowers that qualified under the definitions of new.

The existing renewable facilities program has supported over 4400 megawatts, although currently supporting much less; and providing funding to even less than the 2000 that's there.

Quickly, this is just a quick graph on the emerging, showing the buildup of PV systems installed, and the exponential growth that we see here in the last couple years, with about half of that having received funding from the Energy Commission.

And just another quick graph; the rebate level, just to show that we have been trying to reduce the rebates available to these emerging and

PV systems, it's currently down to $2.80 a watt. And even with the reductions in rebate level the rebate requests continue to grow. And we do anticipate continuing to drop that rebate level. Eventually at some point we may see a leveling off of the requests, but that is the goal of the program is to eliminate the need for those funds.

I'll move on to some of the areas that have provided incentives to biomass facilities. The existing renewables being the primary program area that has provided funding to biomass facilities. The original program from '98 to 2001 provided 45 percent of the overall funds during that time period to existing renewables, with 135 million going to tier 1, which funded solid fuel biomass, solarthermal and waste tire.

Tier 2 was for wind. And tier 3 covered digester gas, landfill, municipal solid waste, among others.

The extension of the program, which is our current situation from 2002 to 2006, tier 3 technologies were eliminated, so there was no more funding for digester, landfill gas, municipal solid waste. We did eliminate the waste tire and the amount of funding available for existing technologies was considerably reduced.

Tier 1, which covers biomass and solarthermal, has about 101 million for the five-year period, which ends up being about 20 million a year.

The funds for the existing renewables facilities program are provided in the form of production incentive, which was as high as 1.5 cents during the first two years of the program for tier 1 facilities.

The current level, though, is now at 1 cent per kilowatt hour. There is a cap on it. The maximum that we will pay is a cent per kilowatt hour. And payments are made based on the difference between a predetermined target price and the market price. The current target for tier 1 facilities is 5.37 cents. Anytime the market price is above that we do not make any payments. Whenever it drops below that then we pay the difference up to the cap.

We currently are supporting 26 biomass facilities; about 120 megawatts. We provided more than 111 million to these solid fuel biomass facilities since '98. We've provided about 2.8 to 25 landfill facilities during the first four years; another 18,000, very small amount, to digester gas.

And a little bit of a disturbing trend is, although we've had a number of facilities restart and increase generation since the beginning of the program, we've also seen a number of facilities drop out.

There have been seven facilities, about 90 megawatts, that have shut down since 1998. And we have at least two of them that participated in the program that have shut down since 2003, late 2003.

And obviously there are a number of other facilities that are in jeopardy of shutting down. I do know of at least one facility whose long-term contract has expired, and basically they've been dropped off of the 5,7 fixed price deals that everybody else is on and off. They're off the SRAC. There are a number of restarts that receive considerably less than a number of the other facilities because just the way they contracts are structured. And their contracts are also due to expire fairly soon. And there is a good possibility that some of those will drop out.

Some of the others that have dropped

were associated with sawmills and with them shutting down; they have shut down, as well.

This graph is basically very long term, all the way from the beginning, showing payments relative to the market price. These market prices are average amongst the different utilities during the time that the power exchange was in place. It also includes power exchange prices. And as you can see, there was a large hiatus there in the middle during the energy crisis when prices shot up, basically all our funds remained in the program and have been available for future.

A number of these current facilities that, as you can see here, the trend in SRAC the last couple of years has been upward, somewhere in the 5 to 6 cent range. And I believe that's what's been able to maintain a number of those facilities that are under short-run avoided cost, is the higher prices for at least the short term.

Here's a quick graph, moving on to the new renewables. This is just an overall showing the megawatts that have come online each year. And the amount that is still planned. Planned in certain cases mean they do have funding awards. A number of those will most likely not come online for a number of reasons. Some may decide to participate in the RPS, and then drop out of the funding that they could have received from this program.

Specifically regarding biomass. There are 21 facilities that were funded. Currently 17 are online. Two small solid fuel biomass, a digester gas, and a number of landfill. Many of those landfill, however, were repowers that qualified under the new.

I'll quickly cover the RPS which is sort of the future here. And where the possibilities for new renewables and for biomass lies. I think Jim Boyd covered this this morning, most of it. The current target -- the original target was 20 percent by 2017. The Governor and the action plan has talked about accelerating that to 2010. And we also currently examining accelerating that even further by 2020, numbers up as high as 33 percent.

Here's just a quick graphic illustrating where we've been as far as historical generation. And the increase that would be required, you know, more than doubling the amount of generation by 2010 in order to meet the 20 percent goal. And in order to reach that 33 percent goal, it would be a substantial increase in the amount of capacity or generation.

This is just a map showing all the renewable projects that the Energy Commission has funded throughout the state. And I think I will leave it at that, since we're well over, and allow time for questions.

(Applause.)

MR. TIANGCO: Thank you, Tony. We have (indiscernible) minutes for question and answers. Questions? Would you please go to the microphone and state your name and affiliation.

MR. CHOPERENA: I'm Joe Choperena. I'm with USDA rural development. And I actually have a question for Ruth MacDougall. You mentioned something in your presentation about I think it was 74 anaerobic digesters throughout the world and none in the U.S. So I'm assuming that's for like larger, like ag waste facilities? Or what specific digesters are you talking about there?

MS. MacDOUGALL: Okay, actually in Europe a lot of those are for municipal solid waste. Europe has very few -- well, I mean there's shrinking landfills, and so their tip fees for landfills are up to $90 to $100 a ton. And also they have an incentive for renewable energy. They've mandated that renewable energy is paid 15 cents a kilowatt hour.

So they have different economic conditions. But -- so they're, you know, digesting some of this municipal solid waste, green waste, biosolids, manure, food waste, et cetera.

That's mostly what it is.

MR. CHOPERENA: Okay. And one other question for Ruth. You mentioned that right now SMUD's renewable energy program is really geared towards just more conventional anaerobic digesters. And that you're looking at incorporating other forms of technology as far as gasification. What other forms would that be? And also is SMUD kind of looking into, because I believe there is a municipal -- or isn't there some type of municipal digestive system going on here in Sacramento?

MS. MacDOUGALL: Well, I mean our wastewater treatment plant is producing biogas. And, no, we're hoping to develop an anaerobic digester in town. We've had a proposal to demonstrate the anaerobic digestion of green waste.

And so it's a technology that's very mature, so we just need to get the partnerships and economics together on it.

MR. CHOPERENA: So that would be the first in the U.S. then?

MS. MacDOUGALL: Yeah. There are a couple in Canada.

MR. CHOPERENA: Okay. And besides gasification like other technologies that you might be using, like how far along is that process, or do you anticipate --

MS. MacDOUGALL: Well, we're performing the inventory right now, and you know, exploring what resources we have. And looking for projects.

MR. CHOPERENA: Okay, thank you

MS. MacDOUGALL: Um-hum.

MR. MUNSON: Steve Munson, Vulcan Power and Silvan Power. Tony, would it make sense for this industry, in terms of future growth, to try to focus on gaining substantial amounts of the healthy forest initiative thinning funds to support new biomass projects and kind of take the pressure off the RPS funding?

In other words, get paid for the fuel to the plant, bring the overall operator costs down.

MR. GONCALVES: Well, anything that can reduce the overall costs is going to make the biomass facilities more cost effective.

Right now I believe that, you know, given the current structure of the biomass industry and biomass facilities, they are significantly more expensive than some of the other traditional renewable fuels. And it is going to make it more difficult for them to compete and be winners within the RPS.

They need to be a winner within the utility solicitation in order to even come to the Energy Commission to qualify for supplemental entry payments. So anything that helps offset their costs before they bid into the utilities is definitely going to help.

MR. TIANGCO: Any questions?

DR. HUGHES: Evan Hughes, Biomass Consultant. For I think for Rachel Goldstein. Are there issues for getting credit for greenhouse gas abatement, getting the full credit for methane versus CO_2 when one could flare it and turn it to CO_2? And for getting credit for doing the greenhouse gas abatement despite what might be controls for local air pollution or odor control, anyway.

How do you address these issues to get the full greenhouse gas credit?

And a quick additional question: What capacity factor do you see on these landfill gas projects? Annual capacity factor?

MS. GOLDSTEIN: You mean capacity factor in terms of what the collection efficiency is and what we use in terms of --

DR. HUGHES: No, converting from kilowatts of power to gigawatt hours per year. What, 85 percent, 80 percent, 60 percent?

MS. GOLDSTEIN: Well, I was going to say typically for a capacity factor for us we're thinking about in terms of what gas gets collected versus fugitive emissions. I might have to get back to you on that one.

DR. HUGHES: Um-hum.

MS. GOLDSTEIN: Regarding the greenhouse gas emissions question, I'm sure you're aware there is no mandatory or regulatory system for greenhouse gas emissions in the United States currently.

There are a few regional systems under

development. For right now I would say the biggest issue in terms of getting any kind of greenhouse gas credit for methane is whether or not it is a federally regulated landfill.

And by that the new source performance standards emission guidelines do require that landfills of a certain size, they're required to collect and combust the landfill gas regardless of whether or not there's an energy project.

And at that point any of these emerging systems are going to look for something that's above and beyond, or additionality to what's currently required.

So you have probably more success for a non NSPS site in terms of any kind of future greenhouse gas credit. Those that, you know, certainly our program doesn't take methane reductions for NSPS sites, -- the offset of a fossil fuel in terms of carbon dioxide equivalence.

And I suspect that any of the emerging systems will probably go along those same lines. You can talk to folks at REGI in the New England States. That's one system. And then the Western Governors Association is also looking at something similar on this side of the country.

And then the Chicago Climate Exchange, which is a voluntary exchange for greenhouse gases again may also have some requirements in terms of what they would consider additionality.

But there isn't anything federally required at this point.

DR. HUGHES: Are Europeans getting credit?

MS. GOLDSTEIN: In terms of any -- I would say I don't believe they're getting credit for things that are required already by environmental laws.

Now, on the Europeans, they're looking, at Kyoto signatories, something that perhaps they would get a clean development mechanism if they developed a project in a developing country, versus something that's in the European Union.

So that there are a number of ways they can look at that in terms of credits. But if it's something that's required by law in their host country, then probably not unless it's something additional to that.

Hope that answered the question.

DR. CALDWELL: Hello, I'm Jim Caldwell

from E3 Regenesis. We work in gasification and biomass-to-fuels.

I'm wondering you've talked a lot about incentives, several of you have talked about incentives for operations that are not profitable in themselves, and need to be subsidized.

What other kind of support is there for those who have technologies which are viable economically, but we just don't have the cash to do it, like bond programs?

MS. GOLDSTEIN: Well, the landfill gas side there are, I would say, some of the state initiatives are probably a little more generous than some of the federal initiatives at this point, or incentives for that program.

But there are also a number of private investors who are looking at renewable energy. So, for example, we had our conference in Baltimore last month and there were a number of financiers there who spoke at our conference talking about that they are looking for projects in which to invest.

I mean it certainly, it's obviously they, you know, you have to pay back, or they want an equity stake. But there are certainly investment dollars out there.

I think certainly the grant programs for landfill gas projects are not really available at the federal level, but some of the states in which I work on the east coast, some of them have some fairly generous state programs in which landfill gas projects have gotten grant money.

So that almost might be a little bit easier to go on a state-to-state level for these power projects.

DR. CALDWELL: Just a followup on that. There are some pollution bonds available, also, right, which can be -- which are federally supported, but the states have to implement them, for pollution reduction?

MS. GOLDSTEIN: Oh, you mean in terms of either SIP credit or pollution control projects?

DR. CALDWELL: Just bonds that are backed by government so that they fund the project and as long as you can show that, you know, that they're sellable as bonds, and you can repay the bond then. It's a way of getting funded for the project.

MS. GOLDSTEIN: I personally haven't seen that in the landfill gas projects. Doesn't mean it's not there, but I haven't personally seen one.

DR. CALDWELL: Thank you.

MR. TIANGCO: Just want to let you know, the last question, in the afternoon session there will be subject on financing and economics of biomass projects, so you may get some of those information this afternoon.

MS. NUTTING: Did you say you have time for one more? I wanted to ask Rachel this question.

And I will answer that gentleman's question about capacity factor for the landfill gas projects. We've probably, my company, Ameresco, we're an energy services company and we've built quite a few of these projects.

In fact, we are the USEPA's industry partner of the year for the past two years. Very proud of that.

But anyway, we typically see about a 93 percent capacity factor. In terms of the reduction credits you were talking about, most of the landfills in the State of California are regulated, are required to put landfill gas collection and control systems in, and unlike other states who are mostly regulated by the federal regs. So we usually do not see emission reduction credits that are available.

But the question I did want to ask, we have seen a increase in the development of landfill gas projects in California, and the RPS has been a great part of that. It has encouraged investor-owned utilities and municipalities to pay a little bit higher rate now to make the economics work for these projects.

But the big barrier we're now finding, as we're able to get PPAs in place and gas agreements in place, is to be able to build these projects and meet the emission standards.

My question to you is has the USEPA tried to work with the Air Quality Management Districts in the State of California to help find emission rates that are commercially viable, that the manufacturers are able to guarantee those emissions so that we can now build those projects that we have power purchase agreements for?

MS. GOLDSTEIN: I was going to say my understanding, obviously, you know, Brian working much more in California than I, I believe that is part of his goals for the territory this year, is to sit down. I believe there's a new head of Cal-EPA that is something that he is looking to really try to find some way of working through that.

That is now the biggest barrier certainly in the state. And that is something that is on the agenda to try to work through and make it beneficial to all parties.

So, --

MS. NUTTING: Great. I've also prepared a briefing paper on some of the problems we've had with a specific project in southern California, in terms of the emission limits. I'd like to give it to you; maybe you can pass that along to Brian. If there's anybody else here that does any work with the AQMDs or is interested in helping, you know, get these emissions set so we can build these projects, I'd be glad to pass that paper along to you.

Thank you.

MS. GOLDSTEIN: I was going to kind of one more thing, back to Linda and the gentleman who had started the questioning with the emissions reductions.

My understanding is certainly some of the contractual arrangements on a project-by-project basis are looking to put that in there as a future consideration. There's certainly contractual arrangements of who has the renewable energy credits, but people are looking at that as a longer term, should a system emerge in which there are credits available, that people are putting that into their contracts now. It's very much on a case-by-case basis.

MS. NUTTING: Thank you.

MR. TIANGCO: It's 12:00 noon. One last question.

DR. HUGHES: Evan Hughes, Biomass Consultant. I'm also here for EPRI at this meeting. And a question relating, I think, for the small engines like the Community Power System.

How many hours of engine life are you thinking of in these generating stations compared to say utility power plants where you say $2000 a kilowatt, but you're talking about a plant that's going to run for 20 or 30 or 40 years.

And I suspect that these smaller engines are not going to run for that long. What kind of hours or years of engine life are you thinking of when you run the economics?

MR. BERGMAN: Good question. For now

there's basically the two units, the one in Walden, Colorado and the one in Zuni, New Mexico. They've both been operating almost 1000 hours, I believe. And that's because the expected life of the engine.

But that's one of the things that we're trying to figure out how long the engines are going to last.

DR. HUGHES: But if you ran at a 15 percent capacity factor you'd need 4000 hours a year.

MR. BERGMAN: Robb.

MR. WALT: The fact of the matter is we don't know how long the engines are going to last. We have been in touch with industry --

MR. TIANGCO: Robb, can you use the microphone, please.

MR. WALT: I'm Robb Walt, President of Community Power Corporation. As Rick and others have mentioned, our work on small modular biopower is still in its infancy. We've been involved with this for about four or five years. We have about 11 sites that are operating. We've accumulated about 3000 hours of engine life.

And it's just very very early. We don't

know the answer to the gentleman's question. It's one we're very concerned about. Obviously the longer life we get out of engines the economics are improved.

We've been in touch with industry representatives that are involved with the internal combustion engines that we've been using, and they predict that we should be able to get about 15,000 hours of engine life, running on very very clean producer gas.

We don't know whether we'll achieve that or not. And that's part of our ongoing product development activities, to monitor these systems and see what we can do.

So far the engines that we have looked at, after about 1000 hours we see absolutely no sign of wear. We're very very encouraged. We do regular oil analyses on these engines. So far we're very very pleased.

But it is clearly too early for us to be able to answer questions like how many tens of thousands of hours we could expect on these engines.

Are there any other questions?

DR. HUGHES: Is there landfill gas

experience or the manure digester engine experience that might give another number on how many hours out of these engines?

MS. GOLDSTEIN: I'd probably have to refer back to the manufacturer of the various engines for it on their fact sheets.

MR. TIANGCO: Thank you. I don't know about you, but I think all the speakers delivered well this morning, and they all --

(Applause.)

DR. JENKINS: Thanks, Val, for moderating the session, an excellent job. Again, thanks to the speakers for all those excellent presentations. I got to hear both presentations simultaneously, of course, so I'm up on everything.

Just a comment on Rachel's remark about Brian, that's Brian Cazone out of USEPA, not me. So if you want information you'll have to go to the federal government there.

And I think we're going to break for lunch at this point. Just a reminder if you asked a question and you didn't leave a business card with Peter here, then would you please give that to him.

And was there anything else I was supposed to take care of -- okay, so lunch is outside in the lobby there. Please help yourself.

And, oh, yeah, just again, all the presentations will be published on the Biomass Collaborative website. There will be a proceedings available from the conference. So I'll let you know when that occurs.

(Whereupon, at 12:07 p.m., the Forum was adjourned, to reconvene at 1:00 p.m., this same day.)

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