

**2008 California Geothermal Summit
Sacramento, California
July 30, 2008**

Final Summary

**California Geothermal Energy Collaborative
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2008 California Geothermal Summit

**Wednesday, July 30, 2008
Embassy Suites Hotel,
100 Capitol Mall, Sacramento, California**



The renewable energy landscape in California is changing. Your input at this Geothermal Summit is important on issues of research, state and federal policies, RPS goals, climate change impact, and transmission decisions.

Meeting the approaching RPS goals will be a daunting challenge for the state. Also, the AB32 greenhouse gas reduction mandate provides additional opportunities and issues for all renewables. The 2008 California Geothermal Summit will focus on what the future holds for the geothermal community, and how we can more effectively partner with other renewable technologies

Sponsored by the California Geothermal Energy Collaborative

Cosponsors:
Geothermal Energy Association and Geothermal Resources Council

2008 California Geothermal Energy Collaborative Summit

AGENDA

8:30 a.m. - Attendee Check-in

9:00 a.m. - Welcome – William Glassley, CGEC Executive Director
Summit Moderator – Karl Gawell, Geothermal Energy Association

9:10 a.m. Future Direction of State and Federal Geothermal Research

Gerry Braun, California Energy Commission; William Glassley, California Geothermal Energy Collaborative; Allan Jelacic, Department of Energy Geothermal Technologies; and Program Manager Ed Wall, DOE Geothermal Technologies

10:00 a.m. Climate Change, RPS, and other federal and state policies affecting geothermal energy
V. John White, Center for Energy Efficiency and Renewable Technologies; Jonathan Weisgall, MidAmerican Energy Holdings Co.

10:30 – 10:45 Break

10:45 a.m. Moderated Discussion: Perspectives on Geothermal R&D Priorities for California
Discussion Leaders: Carol Bruton, Simbol Mining Corp. and Mack Kennedy, Lawrence Berkeley National Laboratory

11:30 a.m. – 1 p.m. LUNCH

1 p.m. Keynote Speaker: Deputy Secretary Eileen Wenger Tutt, Climate Change and Environmental Justice, CalEPA

1:30 p.m. Keynote Speaker: Commissioner Karen Douglas, California Energy Commission

2:00 p.m. Transmission and Renewable Energy - RETI Process, and Western Governors Association Initiative Reports

John McCaul, Geothermal Energy Association and Andy Horne, California State Association of Counties

2:30 p.m. Direct Use and Heat Pumps: Their Role in the California Energy Landscape

Rick Phelps, High Sierra Energy Foundation; Lisa Meline, Meline Engineering

3:00 – 3:15 p.m. Break

3:15 p.m. Status and Outlook: Bureau of Land Management Leasing and PEIS

Kermit Witherbee, BLM Leasing Plans; Jack Peterson, BLM Western Geothermal PEIS

3:45 p.m. Is there a consensus about the future direction/priorities for the CGEC?

Moderated Discussion with audience participation

4:00 p.m. Adjourn

Bureau of Land Management

California-wide Public Meeting for
the Draft of the Western Geothermal PEIS.

July 30, 2008, 5:30 – 7:30 p.m.

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

2008 CGEC Summit Summary

Welcome and Introductions

William Glassley, Executive Director, California Geothermal Energy Collaborative:

I would like to welcome you to our fourth Annual Summit. Before we actually begin, there are a couple of things I would like to go over. First, I would like to thank Associate Director Judy Fischette and Marilyn Nemzer of the Geothermal Education Office for the organization and effort you've put into making this happen.

There are a couple of other things I'd like to mention. First, for those of you who don't know how the Collaborative functions, the support for the Collaborative comes from the State of California through the California Energy Commission PIER Program, and we want to acknowledge their continuing support for this effort. I also would like to thank the Geothermal Resources Council and the Geothermal Energy Association for co-sponsoring this meeting. We wish to note that more than a third of the attendees are new participants in the Collaborative effort and I think that says a lot about what's happening in the geothermal industry.

With respect to the packet, I want to mention a few things that are important. BLM is holding its last public hearing regarding the release of its programmatic EIS for geothermal. That's taking place from 5:30 to 7:30 in the California Energy Commission Hearing Room A, 1516 Ninth Street. We encourage you to attend, because this is going to be the last California hearing.

I also want to note that in your packet is a single page entitled the California Energy Commission Public Interest Energy Research Renewables Program Informational Exchange Workshop. There will be three workshops describing a new effort that will be taking place within PIER that Gerry Braun will be talking about later on today. It is an opportunity to participate in some of the effort that PIER is undertaking as far as research and development with respect to community scale, generation and energy projects. Gerry will give you more details about that.

Karl Gawell, Executive Director of the Geothermal Energy Association has agreed to be the moderator for this meeting, so I will now turn it over to him.

Gawell:

Thank you, Bill. I want to mention my appreciation for all the work that Bill Glassley and Judy Fischette and others have done planning the Summit. I think that there's real value to bring people together and talk about where we're at today, where we're going, how it all fits in. You're going to hear about some of the driving factors in California and across the country such as AB32, the RPS, and to steal a term from the Assistant Secretary of Energy Andy Karsner, I think we're at a point of renaissance for geothermal energy. Keep this in mind; the California Geothermal Energy Collaborative is an all-in group. Anybody who wants to be part of this group is part of it, and its role is to help push development along every year.

Session 1 - Future Direction of State and Federal Geothermal Research

Gawell:

The first panel will cover the *Future Direction of State and Federal Geothermal Research*, so I would ask Gerry Braun, Bill Glassley and Ed Wall to come on up. The first speaker will be Gerry Braun, with the California Energy Commission.

Braun:

Thank you, Karl and Bill. This is an exciting time for geothermal energy, and I want to share few thoughts with you on Renewable Energy R&D and what the Energy Commission's doing in this area. Before I do that, I want to mention and acknowledge we have a really fine team of geothermal veterans at the Energy Commission - Gail Wiggett, Pablo Gutierrez, and John Hingtgen, and also I want to acknowledge the senior leadership of our team, Val Tiangco and Prab Sethi.

What I'd like to do is talk a little bit about the context, how we're thinking about renewable energy technologies, resources, and renewable energy integration, which is a very important topic with the Energy Commission these days. Then I'll talk a little bit about our R&D programs. We have, especially in California, a really robust set of opportunities in renewable energy, technologies that are cost competitive and in many cases commercial. We need to think about how these technologies are deployed in the market. They fit at different levels of the market because their modularity's different, their economies of scale are different, and we need to get our mind around how to optimize this mix of energy technologies. If we don't and if we continue to think about one technology at a time and not how each of them complements one another, we're probably facing a fossil energy future.

In the broader context, for those of you who have as many gray hairs as I do know that California in the 1980s was basically the launch pad for the modern renewable energy industries, especially wind, high temperature solar and biomass. And geothermal was launched well before that in California. We are as a state, resource rich in terms of renewables. We have the best geothermal resources, we have the best directed total solar energy resource in terms of quality, we have major wind energy hotspots, and we have major and substantial agricultural and forestry waste streams that we can use. Not many other states can claim this opportunity.

We're also Research & Development rich, in a sense. We've had, since the '70's, ratepayer-funded, clean energy R&D that was conducted with exciting vision and good effect, and done in a collaborative way involving the state, the utilities, the renewable energy industry, and the federal government.

California also has a portfolio standard which is becoming more aggressive each year, and we have at least in one case some relatively modest incentives, which probably over time will come up to may 20 or 30% of the cost of the solar electricity deployment that's targeted. So we have some carrots and sticks if you will.

We also have a number of targets. In the latest policy report for the Energy Commission, a target of zero energy residential buildings, all new building aims for zero energy by 2020, and all new commercial building aims for zero energy by 2030. And that's a game-changing goal. In the middle, the Biomass Collaborative and many of the people who take a leadership role in that area have been successful in creating a bioenergy action plan for the state, and the targets that came out of that plan are shown here. These are technologies that benefited the community scale.

Now, my next chart is not accurate. In fact I borrowed it from a colleague, but it is intended to convey what I'm trying to say. In the old days of utility planning, utilities tried to come up with the right and optimum mix of resources for their area, and they combined baseload, intermediate, peaking resources, and made sure that they were deployed in the right proportions. We've kind of gone into a natural gas market-driven optimization scenario for our grid and we've maybe lost sight of this way of looking at things to come up with the optimum mix. But combining California's renewable resources, we can have an economy based on renewable energy. We have baseload resources in terms of geothermal and biomass, we have wind, which delivers energy at a range of capacity factors depending on the siting; we have solar which is a natural match to California peaks and can be shifted to match the peaks with thermal energy storage. So we have a real opportunity to optimize our deployment.

Most of you are familiar with the GRDA program administered by Energy Commission. It's been ongoing since 1980 and I think most of you would agree it's made a major contribution in terms of what it can do. And it can do more than just R&D. It supports a range of projects. Although a number of them are R&D, planning, mitigation and other projects are also possible. So the GRDA program is a mainstay of our research in geothermal.

Now I want to talk a little bit about the renewable energy collaboratives, because this meeting is co-sponsored by the California Geothermal Energy Collaborative. We are looking to the collaboratives for a much greater contribution even than before, especially in the research area. We currently have three collaboratives – geothermal, biomass and wind, and we're hoping to soon add a solar as the fourth. They were created as statewide networks of government, industry, environmental groups and educational institutions. What we hope in the future is that research will be increasingly collaborative in bringing in partnerships with our PIER program and involving all of the state boards.

What I see as really important as renewables take more center stage in the energy vision of the country and the state, is we have excellent assessments and forecasts for our California renewable resources, thanks to the collaboratives. They need to be even more accurate and precise. We need supply curves that we can believe in for each of the renewable resources that the state is going to be looking to. We need the collaboratives to do a good job of assessing the next generation technologies, and we need some really serious and careful thought about the optimum scenarios to get beyond the 33% and into a renewable based future. So we are committing two years of funding to all of our collaboratives. We think this will help synchronize their activities and let them to work together on a stable basis.

I want to mention development demonstration briefly. In the past, we have focused on strategies of creating new options and improving existing options. GRDA has a major contribution in both areas, but there are a lot of commercial renewable energy technologies that need to be deployed. We're shifting our focus to enabling deployment because the state has put an obligation on the

utilities to do that, and because state law that says that we need to address climate change. Addressing climate change is going to require contributions, not just from the utility purchases agreements, but from deployment agreement at all levels in the market. So we're organizing the Energy Commission Renewables Program a bit differently. We're organizing our next round of program solicitations according to the three categories: first - utility scale renewables such as big wind, big solar, geothermal, feeding it at the high voltage transmission level, second - renewable energy-secure communities and third - renewable building scale projects. There are a lot of communities in California that are more aggressive than the state in some ways. They're looking at 100% renewables and trying to find ways that they can exploit local resources to accomplish that. And then the same opportunities exist with buildings. If you are looking at just one renewable source, maybe you can't have a totally net zero building, but if you look at a mix of renewable sources in a building it is possible.

Bill mentioned the solicitation. I just want to give you a quick couple of points on it. What we're looking to do is pilot net-zero communities. Not necessarily in one step, one giant leap, but aim over time to get to a point of full reliance on renewable energy. And we would expect communities to be using a mix of baseload and intermittent resources such as bio-waste and PV and geothermal. We seem to have an electricity focus. There are cost-effective thermal applications and renewables that frankly we have not been paying enough attention to, partly because they don't need a lot of R&D. However, they do need policy attention. So we want to work with progressive communities and progressive members of the renewable energy industry and university campuses. I mentioned "a community choice aggregation candidate," that's a term that you probably should get acquainted with because there's a law in California that allows local jurisdictions to secure a renewable energy supply and make it available to their energy customers in their area with the help of the incumbent electric utilities.

There are three focus workshops on renewable energy secure communities. They are August 6th in Sacramento, August 8th in Downey, and August 12th in San Francisco. Tomorrow we have a workshop at the Commission that is focusing on working technology for the integration of renewables.

In summary, we will continue and we're delighted to have the opportunity to continue to administer the GRDA program. It's been successful, it's a good model and we don't intend to change it. Meanwhile, PIER program emphasis is shifting to renewable energy integration, and I mentioned the areas that we're targeting. We're looking as we shift directions to the collaboratives for leadership, for upgrading and validating resources assessments and supply curves, for organizing and bringing together the partners in the collaborative research and participation in some of the renewable energy integration pilots that we're hoping to accomplish through our solicitations. Thank you very much.

Gawell:

Thank you, Gerry. I think your presentation is a sort of natural lead-in to Bill Glassley's presentation because you dovetailed how does the collaborative fit in, and Bill is going to talk about the Geothermal Development Plan. We had a workshop of the California Collaborative to get input in terms of what types of things could we do, and it was a very broad discussion on everything from direct use to policy to large scale power that needs to be done, then we developed a written document that looks at what we think geothermal energy future should be.

Glassley:

There are a couple of things that I want to cover. One is what's going on with the Collaborative right now, and then talk a little bit about the Development Plan that Karl just mentioned and conclude with a brief discussion of what we expect the Collaborative to be pursuing in 2008-2009.

The key developments that have happened over the last several months mainly came about as the result of how PIER is evolving in the way it's going to be supporting renewable energy research in the state of California. That evolution has forced us to consider how the Geothermal Collaborative should be functioning. The CEC has developed the idea that there should be an umbrella structure that would contain all of the collaborative, biomass, geothermal, wind and solar. Folding the Geothermal Collaborative into that umbrella group has a number of important benefits to us, but at the same time, the Geothermal Collaborative remains independent. We will continue doing the kind of work that we've done in the past but this gives us the opportunity to interact much more directly with the other renewable areas. This will be an opportunity to brainstorm with the other collaboratives about how best to integrate geothermal, biomass, wind and solar in applications where those kinds of integrated approaches could be useful. It also provides us with the opportunity of achieving efficiencies with respect to how we administer the different collaboratives and end up being much more coordinated in dealing with the renewable landscape in the state of California. The other thing that I think is going to be a benefit to us in having this kind of structure is that it's a means to more directly and effectively communicate with PIER about what we, as the geothermal community, believe should be the RD&D goals and directions we should be moving. In the end this is going to end up being a much tighter approach to how the state of California deals with the challenges respecting renewable energy.

I want to get to the Development Plan but want to start with a graph on RPS goals. Many of you have seen this graph in various forms, and in fact, it's already out of date with respect to what the targets are up there. What it shows is the renewable energy technologies that exist within the state in 2004. If you look at how they move into the future trying to meet RPS goals in 2010 and 2020, the challenge is huge. In order for the state of California to achieve what it claimed it's going to achieve or at least target goals, it has a daunting task ahead of it.

If you just look at geothermal you get some idea of the magnitude of this problem, and I'm sure many of you are already aware of this. On the right hand side is a graph of the gigawatt hours produced in the state of California from geothermal, the total in black, IOUs in red and non-IOUs in blue. The geothermal growth rate in the early 1980s was on the order of 10% per year. The growth rate currently is about 1% per year. There is no way geothermal will be able to move into what it potentially could contribute to meeting the RPS goals if we actually proceed at this rate of 1% a year. We have to find ways of improving and accelerating contributions to geothermal. The same thing is true for low temperature and direct use applications. Both of those areas in the last few years have been almost stagnant. There have been some new applications that have come online but very, very few.

Because of these challenges we undertook about a year and a half ago to try to create a Development Plan for how best to move geothermal forward. We divided the challenge into three separate tasks, Geothermal Resources, which was led by Mack Kennedy and Paul Brophy, Streamlining Permitting and Leasing led by Charlene Wardlow and Laurie Hietter, and

Governmental Policies and Marketplace Approaches which was led by Karl Gawell and Jonathan Weisgall. These individuals put together an evaluation of each particular task areas and presented them at a 2007 workshop in Woodland, California, facilitated and developed by Judy Fischette and supported by the California Energy Commission.

A workshop summary is located on the CGEC website, but in your packet, is a copy of the Development Plan that evolved from both what the task working groups put together and the discussions that took place at that workshop. We want to finalize the document by October and use it as the basis for developing a timeline of specific tasks that need to be accomplished in order to move geothermal forward with a budget to do so. I would very much appreciate it if all of you here would comment on it, give us your concepts, approaches, reactions to it, things you think should be changed or emphasized, what you think costs would be, what you think timelines would be. All the input for this particular document would be greatly appreciated because it's going to be the basis for how we move forward in the future.

The last thing I want to mention is what we're going to be doing with the Collaborative over the next year and a half. There are four principal tasks we must accomplish. One is to complete by September, the integration of the collaborative into the umbrella structure that I mentioned at the beginning. That will be centered at UC Davis where the umbrella structure will actually be established, and administered.

One of the other tasks we want to do is build on what the USGS is doing right now with their resources assessment. Working with them, identify the data needed, approach to how research needs to be done in the Geothermal Resource area, and essentially initiate a next generation resource assessment of the state. It will be at a much higher resolution the USGS survey. It will begin to encourage technology development, hopefully, that can occur within the geothermal community.

The third task we want to undertake is to construct a statewide high resolution, or at least much higher resolution than currently existing, map that outlines or evaluates cost benefits of low temperature installations, potentially involving areas such as direct or district heating applications or local building applications or energy-secure communities. This kind of information would provide those who are interested in these technologies with a basis for moving forward, and understanding what the benefits could be. The intent is to have this information available on our Collaborative website including all the data that is collected as responses for developing that map. The same thing would be true also for the high temperature resource assessment.

Finally, building on what the Development Plan has considered, we want to identify specific barriers to market for different aspects of geothermal. We will be looking for strategies to resolve those challenges, and build a roadmap, a timeline of how best to move forward. Those are the principal tasks we intend to undertake in the coming year and a half and the direction we hope to move with the Collaborative.

I'd like to stop here and give Ed Wall a chance to speak. I think what he has to say is going to be of interest too. I'd be happy to talk to anybody afterwards.

Gawell:

I've been pretty excited by what I've seen Ed Wall, the new Director of the DOE Geothermal Program, start doing. Ed actually has a geology background and used to work with USGS. He also had a very prominent role with the Department of Energy as Director of the Office of FreedomCAR and Vehicle Technologies. And the impression I got from those people was that he was very well respected as somebody who's real forward thinking. I hope we can work with Ed on really making this renaissance for geothermal energy work, and hope this is the beginning of a long relationship. Ed?

Wall:

Thank you, Karl. I've been on the job about four weeks now, and I've been on the road three of those four. I'm trying to get out and touch base with the various groups in this area that understand the technology, and have been really carrying the torch over the last few years. This is a great opportunity for me, I'm really looking forward to hearing from each of you and learning from you as we shape the new direction for the program in Washington.

I think integration has been mentioned by each of the speakers this morning. That's a key point. From my own viewpoint, running the vehicles program at DOE for four years, I think we see electricity as being a central component to personal transportation in the future, and in particular the benefits of plug-in hybrids. I think we'll also see pure electrics going forward. And one of the things that comes to mind is where are we going to get the electricity? Is it just pouring on more coal? Well, I'm not sure that is to all of our benefits. Having renewable baseload electric generation is going to be critical to the future we see in transportation, as well as, the future we see in buildings and housing. We see folks working back at DOE with our building programs to create a zero energy future in housing. I guess one of the things that caused Andy Karsner, Assistant Secretary, to use the word renaissance is he's familiar with the MIT study that came out a little over a year ago. The findings of that study suggest that as we consider the potential of enhanced geothermal systems that we're not just talking about a few states. We're not just talking about one region, the West, we're really talking about a nationwide resource and really the only renewable resource that can provide baseload power.

So another important implication of the MIT study is that high value jobs are linked to what we're talking about doing here. The vision of a hundred gigawatts of geothermal power by 2050 will result in high value jobs in drilling, in construction of the infrastructure, and then operation of power plant facilities. We think this is a good thing as well. Many of you already know the key components of the enhanced geothermal system that MIT posited could be a major contributor is the drilling of an exploratory well, the identification of the prospective formations, the use of stimulation to energy in essence an underground heat exchanger. The use of remote seismic to identify the extent of the fracture formation and drilling a second well, the production well, so you have injection at one well site and production off the other through this underground system that's been created. There are critical research aspects that need to be explored, but we think there's tremendous potential across the country. I think there's a confluence of events right now; things are coming together that are helping to put geothermal in the national spotlight. Certainly rising energy prices are focusing people's attention. There is a need for more electric generating capacity, particularly renewable baseload, and concerns about the greenhouse gas emissions from other types of power generation. Certainly all of these things are prompting a vigorous look at the potential geothermal has to offer. The finance workshop that GEA sponsored last week in New York was very exciting, a standing room only crowd from the

finance community, banks, venture capitalists, investment firms. Considerable energy in the discussions that took place there, and hopefully, some linkages will result in financing help for geothermal move forward.

In the industry as Karl mentioned we're working now to form partnerships. We're looking at working with our partners within the government to speed up the leasing process. We're looking at international government cooperation, information exchange, and collaborative agreements. And we're looking at forming partnerships among geothermal developers similar to the oil and gas industry, and service companies. Utilities are critical components of this partnership.

And within the government right now we have the production tax credit. We have a loan guarantee opportunity that is open right now and for the first time we have a specific mention of geothermal projects in that loan guarantee. That took some effort. I know Allan Jelacic worked hard to get that in there, and we're very happy that nearly eleven billion dollars will be available for projects that can be guaranteed as energy efficient and renewable energy, and geothermal is one of them. So hopefully we'll see some very good proposals come in under the loan guarantee.

The DOE approach is to support R&D with an emphasis on enhanced geothermal systems while supporting conventional hydrothermal technology. We're looking to cost share in field development projects - EGS using a marginal hydrothermal in oil and gas wells, principally. We're looking at removal of institutional barriers. Certainly an improved or accelerated leasing regime is part of that, but we're also looking at approaches to reduce the risk to investors, and we will do that by putting together a data center. We want to see improved emphasis in the educational area as well. Also on this list is a sustainable drilling fund, exploring the right approach right now of cost sharing in exploratory well drilling since that's the big up-front investment that's most at risk since the majority of wells are essentially dry holes. And as I mentioned, the loan guarantee opportunity. If you know of possible projects that are about ready or could be started soon, that would be topics for that, please give it a consideration.

When we look at our budget, this is the breakout for the '08 funding. There's 20 million in '08. The '09 request is 30 million. The lion's share of the 20 million, about 12 ½ million, is set aside for awards on the solicitation on the street right. It opened on the 18th of June, and it's scheduled to close on August 12th. We held a telecom last week to answer questions from potential respondents. All the Q & A's from last week's telecom have been posted on the solicitation website. There are two topic areas: one's component technology R&D, the other is system demonstrations. We are looking at exposing up to 90 million dollars over the next four years to support the selections from the solicitation. I think Congress and other interested parties will be watching the response to gauge whether the time is, in fact, right for geothermal. So we're urging everyone to consider applying. We're looking for teaming arrangements, so it doesn't have to be individual companies, it could be groups.

The other thing is, since it closes on the 12th I would mention this is an electronic filing. If you or someone you know has not responded to one of these electronic solicitations in the past, don't wait till the last day. I would advise at least attempting to file by the 8th of August so if there is a glitch you can work with the Golden Field Office to make sure that the electronic filing does actually make it in. I know in the vehicles program we had experience with some good proposals that waited until the last day and due to glitches in the electronic system did not make

it in for consideration and that was a shame. We don't want that to happen in geothermal. If we look at the topics in the solicitation there are seven R&D topics that have been identified through analysis of current technology and where some of the biggest needs are. We felt these were the highest priorities. We're going to have a follow on solicitation next year, so we're interested in your thoughts. If there are areas that need additional emphasis, please let myself or Allan Jelacic know, that's one of the reasons we're here. In the area of system demonstrations, we're using this solicitation to focus on the first two elements of the three elements as part of our multi-year program plan and we're looking at taking existing wells on the margins of producing fields, stimulating them and demonstrating improved performance. The third element, the green field developments, will be an element of future solicitations.

Right now we're looking at a study that Dwight did for us that came out earlier this year which identified things the government could do to reduce the risk of investment in geothermal. One of the recommendations in the report was creating a multipurpose national database of existing and historical geothermal data. We're in the final stages of putting this solicitation together now that would seek organizations to start up this database. We're interested in your input on the types of data and the information steps that are most important, well data and exploration data of all types are being considered.

With regard to education, we see a trained workforce as an important component of the future of geothermal development. We're in the early stages of developing a geothermal education program. We're going to consider curriculum development in engineering schools around the country. We're following some educational examples we developed in the vehicles program creating graduate centers. Also we are thinking of initiating scholarships to some students to both work abroad and to work in specific areas to promote geothermal development. We're considering a university student competition where we could potentially put out a problem for universities to consider, propose a solution on, and work with one of our industry partners, perhaps having the winning solution actually implemented in the field. We're looking also at vocational training and ultimately to spread the message around the country that we need to enhance our K-12 education and develop an education module in that area.

On the international front, we have a longstanding IA for a geothermal implementing agreement that's been going on for about ten years. We have currently written a draft charter for our international partnership on geothermal technology that would consist of Iceland, Australia and the United States, but we would set it up with an eye to expansion to other countries in the coming years. Now, we're working with the International Policy Office at the Department of Energy to have it approved by the State Department in time for a late August signing ceremony in Iceland. So that's one that's on a fast track. Both Allan Jelacic and I have been personally involved with trying to get that one though the bureaucratic hurdles of the general council as well as the policy office of DOE so we can get that in place.

Probably the biggest challenge for all of us and one that I've raised with our office is the need to raise the visibility of geothermal as a renewable that can deliver baseload electricity generation. And we'll know we've been successful whenever someone kicks off their speech to Congress or their address to the public by mentioning geothermal in the same sentence with wind, solar and biomass. We do note that Al Gore mentioned it early this month. This is exactly the sort of thing we're looking for. But that's something that really all of us can play a role in. It will take

a lot of work nationwide to make sure that geothermal has the same visibility as the other renewables.

I'm very pleased with the report we've received and we've seen from Congress. I mentioned before, the budget request for fiscal year 2009; the federal spending year that will begin on October 1st of this year. The House marked the administration request for 30 million, 10 million more than this year. The House marked it 50 million, though the language that came with that mark was focused primarily or really solely on enhanced geothermal systems. Senate marked at 30 million; however they gave a much broader mandate, with authorizations to give us a broad authority to work the entire continuum of geothermal from ground source heat pumps all the way to enhanced geothermal systems. And actually, if anyone asks me, my preference would be to have the House mark the Senate language. That would give us the most flexibility to move this program into the future. From our multi-year program plan this is our vision for the future for geothermal, and I share Andy's view that today we're entering a new era for geothermal energy in this country and around the world. And together, we can assure a significant contribution. Our future power will come from this clean domestic source. I thank you.

Gawell:

Thank you, Ed. I appreciate your comments. I'm going to ask each of you some questions. I think it was Dan Riker or a staff member who pointed out when they Google search geothermal they have so many hits, solar and wind do much better. So that's not where we want to be. When they Google searched clean coal, they got two times the number of responses of solar energy, so their numbers are really up there.

I want to ask each of you how you view the issue of collaboration between your stakeholders. Ed represents the federal government. Bill, you represent everybody else because the collaborative includes a broad range of the geothermal community including individual companies, community groups, environmental groups and others. And Gerry represents the state of California. What would be the thing you would say people need to understand about working with you and your mandate? There are always restrictions or things that must be highlighted when working with the state or the federal governments. So to have this collaboration going forward, what are the things you would say to the others?

Braun:

Well, as I've said before, I'm old enough to remember the days when collaboration in R&D projects was the norm and especially in California we had all of our major California utilities working together, cosponsoring projects with the Department of Energy involving the Energy Commission and involving the major renewable energy industry stakeholders, and that's how we ended up with the next generation of wind turbines, major research experiments in photovoltaics and other developments in advanced fossil energy conversion. We need to restart that process, and in terms of working with the Energy Commission, we have some guideposts and fences that we have to work within. One of them is for development of demonstration projects. Also we're in a mode of competitive solicitation. I believe that if we start at the research phase, that's where we're hoping that collaboratives can focus. Then we will be forming partnerships that can move forward and basically be the game on a particular topic. And in that case, it's not so difficult to consider a state R&D program joining and supporting a major initiative that has a lot of base to it

in terms of other partners and other sponsors. But as long as we're the primary sponsor of the R&D project, it's got to be done competitively. If we can spread it out and get broader participation, we can probably do a lot more and we'll all have more leverage.

Wall:

My background coming from the automotive side is one where we heavily leveraged collaborations we put together in the case of the FreedomCar and car fuel partnerships that involved the auto and the energy industries. It's now the utility industries being added along with the national laboratories and universities. So we saw that as the basis of collaboration where together we set the research priorities with federal funding behind it, but frequently joint solicitations. I know in the area of, thermoelectric conversion of waste into electricity, the California Energy Commission jointly sponsored a solicitation with DOE. We both put money into a recent solicitation in that area, so I'd say that's another potential area of working together to support the R&D side. And we need to look at what incentives really are going to help, and which ones are just going to give additional funds to people who are going to do something anyway. We want our incentives to push companies and push efforts beyond where they would be.

I think the requirements for competitions, and competitive solicitations are something we face just like the states, and that's something to keep in mind. The other thing is that the process is not always as fast as we would like it. If I decide today I want to do a solicitation it would probably take at a minimum three months to have it on the street, but the awards would be more like at a minimum nine months down the road. So it's sometimes been frustrating as program manager where we want to respond rapidly to a rapidly changing environment and be saddled with a bureaucratic system isn't that fast.

Glassley:

The collaborative is an amazing organization given the diversity of skills, interest, backgrounds that exist here, and I think one of the things that is lacking is its sharing of information. For those of us who are involved in the collaborative at the administrative level, which happen when I was with the CEC as well, is the ability to respond quickly. You'd get phone calls from people wanting to do various kinds of applications. They have no idea where to go to get the information, and it's difficult pointing them in a specific direction because the information that's available on what you may want to do, how you would do it, what are the cost benefits, who would do it for you if you wanted to contract - that information is extremely difficult to come by.

At least as far as the collaborative is concerned, collaboration among all the different entities to develop some way of getting information accessible easily is something we need to think about. Karl's comment about Googling geothermal, even given the paucity of information that's out there, is how do you sort through it if you don't have a lot of background to start with. So we need to find a way of communicating to the public at large, using a different vocabulary from the one we usually use; a vocabulary that would be much more common and understandable. We need to develop something that people can access easily to find the information that's out there.

Braun:

I have one footnote that I think is really important, and that is the California investor-owned utilities under the obligations that they face to meet the portfolio goals, are now proposing to get back into the RD&D business in a big way in renewables. The total two-year request collectively for the three major electric IOUs is in the area of a hundred million dollars. It would be a really good idea for the Geothermal Collaborative to reach out and for the industry to reach out to them. This is R&D money, but it is a way of getting the right proportion of attention paid to geothermal as the utilities start thinking seriously about where they're going to get all of this renewable electricity.

Gawell:

Good point. We'll take a couple of questions. Does anyone have a question for the panel? Can I ask you to introduce yourself?

Anna:

Anna Carter, independent consultant for geothermal energy. I have a question about the administrative aspect of UC Davis overseeing the collaboratives together, what does it consist of, what are its responsibilities?

Braun:

Two or three of the existing collaboratives have been nurtured within UC Davis framework, and basically the university provides a home for the collaboratives, a place for staff to work. In the case of the consolidation of the funding for four collaboratives, it's more efficient by a long shot administratively to have a single funding channel. As to the value added by the university - they have graduate students to do some of the R&D tasks, principal investigators, and the senior faculty members who add a lot of value in terms of their technical expertise. So that's kind of the rationale for basing it at a university, but there's no constraint on how the collaborative can function in terms of its own individual requirements.

They're not purely administrative and they're certainly not hierarchical. I think that's kind of an oxymoron in academia. Obviously there has to be a contract with someone for the funds to flow to support the staff, to support the research tasks. Somebody has to organize that, since there are too many research tasks and too many people involved to be contracting individually.

I think the primary function is technical leadership, which is the type that Bill Glassley is in a position to provide.

Glassley:

In the past, every year the collaboratives had to go through a proposal to be funded through the next year, and it is a daunting enterprise.

One advantage we have is that by having all of the collaboratives under one umbrella at UC Davis, the university can deal with that contracting situation and it can become a two-year contract. The other thing that I think is value added is the opportunity for each collaborative to

understand better what the other renewable areas are doing, what their challenges are, what their needs are. Through the discussions we've already had in workshops, there has been an explosion of excitement about opportunities where geothermal could contribute to the success of some of the other renewable areas, and vice versa. And I think in the end for us it will give us much greater visibility, much higher profile, and many more opportunities, so I think that's part of what will come from that kind of organization.

Jim Combs:

Will the PowerPoint presentation to be put on the website?

Gawell:

Judy mentioned earlier in the day that all the PowerPoint presentations will be on the CGEC website, and they are going to have a summary of the meeting but that will take a little bit longer.

Dennis Murphy from Potter Drilling:

I'm working on enabling drilling technology for EGS or ground source heat pumps, so in the DOE talk, I couldn't help but notice that there was no attention to drilling technology, so that's question number one. Question number two involves more order of magnitude in terms of funding. There's the 90 million dollars outlay of which 30 million in '09. We couldn't help notice that the carbon capture and storage budget is 30 billion to 290 million in '09. So is there any way that we can maybe just swap titles?

Wall:

That'd work for me. Actually, as far as the funding goes, given what Karl referred to as our near death experience two years ago where zero was requested, we see real progress in having a 30 million request. We're in the process of preparing the 2010 budget internally, one that'll go to OMB in the fall and on to Congress in February, and I'm hopeful we can move it on up from there as we search for an optimum level to get done what we need to. In terms of the drilling technologies, let's talk during the course of this Summit; please come up with specifics because that's the sort of thing we want to incorporate in the next solicitation.

Charlene Wardlow of Ormat:

At Sandia Labs in Albuquerque, there was both a geothermal drilling and logging group. Are those going to be continued to be funded because they were doing R&D for both geothermal drilling and for downhole hot temperature logging tools.

Wall:

On my list of places to visit is Sandia. I hope to be there within the next month and see first hand what is currently ongoing. I am aware of work in the drilling area that is still taking place there, so we will be assessing it. One of the things we've been talking about is the need to identify at each of the labs, which areas are unique and don't exist elsewhere, so that we can continue to support them. So I'll jot down your comments, your observations on those areas.

Session 2 - Climate Change, RPS, and Other Federal and State Policies Affecting Geothermal Energy

Gawell:

Next we're going to get into a discussion about Climate Change, RPS, and other policies affecting geothermal energy. This will include events in Washington and California. Following that we're going to have a moderated discussion on Perspectives on Geothermal R&D Priorities for California. I want to note that we have a long lunch time for a networking lunch period, so there's enough time for everyone to get a chance to meet with each other and talk with Ed or Gerry directly about specific issues.

I think we all know that no matter where we are, we have drummers sort of driving us these days. I think you can see how Congress loves renewable energy; they just don't know whether they want to pay anything for renewable energy. You see the same thing at the state level. How high can you jump, and by the way can you jump higher? The questions that are being posed are amazing, and we have two people here, John White, the Executive Director for CEERT (the Center for Energy Efficiency and Renewable Technologies) in Sacramento and Jonathan Weisgall, Vice President for Mid-American Energy and Cal Energy, who are intimately involved in what's happening both in Washington and at the state level about some of those drivers. Where things are going at the state and federal level is particularly critical because we're talking about a development plan, we're talking about efforts that are going to take years to put together. So we need to be thinking about where things are today and where they are heading over the next four or five years, not just what's happening tomorrow. John, I'll turn it over to you first.

White:

Since Jonathan's the chairman of my board, I always follow him, but this time, I'll start since I'm part of the host committee for Sacramento. This is where I live, make my home, so welcome to the capital city.

The end of our legislative session is approaching, the end of two years of effort not always leading to perfect results. California has a budget shortfall of some 15 billion dollars which is preoccupying the elected officials and the governor. We also have a drought that we're responding to, so there's an effort being made to develop a water bond. And the third issue that is still on the agenda, and we hope getting some traction between now and the end of August is the renewable reform agenda that would include the establishment of a 33% renewable portfolio standard by 2020 that would apply across the board to all load serving energies, direct access, providers, municipal utilities and investor owned utilities. This is something we've been working on as an organization for some time, and it actually came about from a kind of shift in our philosophy and our approach to working on this. We have been engaged since 2002 in the implementation of the California Renewable Portfolio Standard Law which originally put in place the 20% target which was then accelerated to 2010. Unfortunately, that law has built into it a labyrinth of procedures and complexity not unlike other aspects of California law. My daughter is taking the California Bar Exam today and it's a three-day exam which is longer and harder and has more stuff on it than anywhere else. So it's just like the permitting process. Our RPS law has a particular set of features that make it harder to work with from a standpoint of providing certainty. One of the problems with the law is that it ties the cost of renewables to the

expected price of fossil fuels, and as everybody knows the expected price of fossil fuel is not what the price has turned out to be. In fact, we have had approximately a tripling of the cost of natural gas in the last five years. Unexpected, not forecasted, the experts got it wrong. As a result, we undervalued the contribution of renewables, and we underpaid for the renewables that we bought, and as a consequence, some of the projects that got selected aren't getting built. Now this is commonly called contract failure, but in my mind it has to do with not enough money. People bid projects in order to win bids and not necessarily with the full support of their bankers.

There are also transmission problems. We have been unhappy about this situation. But we got tired of being in that kind of negative place, so when we passed the Climate Change bill AB32, which set in place a statute that requires the state of California to get to a 1990 CO₂ level by the year 2020, we decided to think about what that might look like if it was successful. And what would our renewable portfolio look like if we were successful in actually achieving renewables as a very significant fraction of the California energy portfolio. That's when we started working very seriously on transmission issues, because when you look at California's renewable resource base, we are really uniquely blessed among states. We have world class wind resources with some areas still to be developed. Solano County has about another thousand megawatts remaining, the Altamont has some more that could be re-powered, but the real treasure trove of undeveloped wind is in Tehachapi. But you need transmission to get it north and to get it south. Then you go down to Imperial, and you have the cornucopia of geothermal, a perfectly beautiful baseload resource, and a very nice substitute for coal.

Wind, as you know, tends to be a fuel saver more than a capacity builder, although it does provide some capacity. Geothermal, on the other hand, is a workhorse and I think that's going to be its long term strength. It'll be the baseload resource for the renewable portfolio. The solar resources over in the Mojave and Imperial are also world class. They are very significant quality resources, and unlike other parts of the world where there is great solar, in the Gobi Desert and the Sahara, this solar resource is close to the load, within 100 miles of 10 million people.

So we began to work on transmission and renewable developments kind of going together, and I think that shift in emphasis from the project by project, little pieces here and there, to really thinking about what a build out of the resources would look like has animated our work, and I think we've begun to shape state policy. As you'll hear later today from your excellent representative John McCaul, the Renewable Energy Transmission Initiative has begun to really start to get people's attention. CEERT has been involved as a facilitator. Normally we're advocates, so we're kind of prisoners of the RETI process because our job is to get everybody to work together, as opposed to say what we think all the time. On the other hand, we have been successful I think in beginning to forge, maybe not an integration of the agencies into a single one-stop permitting shop that people might someday aspire to, but maybe a virtual integration where we at least begin to have the ISO and the PUC and the publicly owned utilities in dialog about where we want to put the corridors, and what the routes should be and the need to match procurement with transmission to cities. So all of that work is now culminating in a report that will be out later next month that will be a first step in identifying transmission corridors. The Texas model of the CREZ that you may have heard about, the Texas Public Utilities Commission just authorized 4.9 billion worth of new transmission to support wind. I think the RETI announcement won't be as dramatic as that, but I think it'll be significant.

We also have legislation pending and high level negotiations going on even as we speak about putting in place the 33% renewable portfolio standard hopefully with some streamlining and some simplification of the law that will enable us to move forward and really make renewables the center of the plate instead of being a side salad on the greasy fossil fuel burger. We want to make the renewables the centerpiece of the meal, and we look forward to having geothermal play a very significant role. I know that solar and wind often gets more attention, but we never forget geothermal because we know what it can do. We also have great hopes and expectations for the potential in our neighboring states, and the low temperature, medium temperature geothermal resource is a very important resource regionally as part of the shift. A lot of you have spent time in the trenches working to develop these resources. I think the time is coming when renewables will be at the center of the energy portfolio and it's going to be our collective job to deliver on that potential and to execute, get people working together, get the permitting process to work better, get the transmission in the ground, and hopefully next time we meet we'll have some successes to talk about, so I thank you.

Weisgall:

Let me get started. I want to turn to federal issues, but I can't avoid the desire to get on a soapbox and talk about California's 20% renewable portfolio standard. John was very diplomatic. You talked about a labyrinth of procedures and complexity. That's much more diplomatic a term than I would use. I would call California's 20% RPS a joke. This is a law passed in 2002 and in six years the state has got 400 megawatts of new renewable resources in place - 8,000 megawatts of gas and 400 of renewables. That's a heck of a track record.

One of the utilities of my company, Mid-American Energy, has put in 1,200 megawatts of wind in Iowa in three years. I don't really know how to account for this. Maybe it's we'll pass the law, it'll happen; maybe some of this relates to my more favorite phrases about everyone wants to go to heaven but no one wants to die. And maybe AB32 will actually make this happen. How did California's renewables get here? You saw Bill Glassley's graph, and that 10% growth in the 1990s, that was PURPA, folks, that was Public Utility Regulatory Policy Act. That was nothing about an RPS. So there's going to be a huge challenge in this state.

Let me talk about some major challenges that will tie into climate change that we're going to see with some of the policy points back in Washington, and some general points to keep in mind nationwide. One of the speakers alluded to the huge commodity price increases in the last five to seven years due largely to competition from China and India. We have seen steel prices in eight years go from \$425 a ton to \$1,200. We've seen copper go from \$1,700 a ton to nearly \$8,000. Natural gas prices are hovering around \$2 to \$2.25 per million BTU as high as 12, affecting benchmarks for renewables. In my company, we've seen the price of wind turbines, we do wind and geothermal, we've seen wind turbines more than double. Over the next five years electricity prices in this country are going to double without any regard to climate change legislation. Keep in mind that's also going to have an impact on subsidies; it's going to have a big impact on the overall climate change debate.

California's an exception, but in the rest of the nation we're seeing some rather troublesome customer behavior. Aside from population increases, we are seeing large per capita energy consumption increases. We are seeing bigger televisions, more sophisticated computers, other electronics, and higher expectations for power quality. And the result - a reduced tolerance for

outages, ever increasing demand for energy, and the consumer still wants the energy to be reasonably priced.

We're seeing that many utilities do not have the excess generating capacity they need to manage their growth. Whether its generation or transmission, a lot of utilities in this country are living off the build-out that ended pretty much in the 1970's, and they are living off reserve margins with very little new baseload generation. And the real paradox in the climate change implementation is how can we reduce CO₂ emissions across the system while satisfying ever increasing customer electric demand, increasing load growth, with the lowest possible cost impacts? Very tough. I do think we can achieve 60-80% reductions in greenhouse gas emissions by 2050 because there is a timeline, but we must develop the technologies to get these reductions in place without killing the consumer.

The political challenge, kind of threading the needle I would call it. We've got to put a price on carbon emissions high enough to ensure that utilities are just not buying emission allowances to meet their pollution requirements, but not so high that it's politically unsustainable, because if it's too high it's going to be a poison pill on our economy. So we've got to manage expectations. I for one was delighted that Al Gore mentioned geothermal three times on *Meet the Press*. I was not delighted that he called for 100% use of renewables in 10 years. It doesn't help what we in the renewable community are trying to do. I don't like it when I see Proposition 7, the Solar and Clean Energy Act of 2008, which is going to be on the ballot in California this November with a goal of 50% RPS by 2025; also with a maximum 3% increase in consumer bills. Talk about everybody wanting to go to heaven and no one wanting to die. So you've got John White, active in renewable energy in the environmental community, fighting a ridiculous kind of a challenge.

With that background let's look at specific federal policy issues right now. I do think that as we move toward pricing of carbon such as a carbon tax or cap and trade and some kind of carbon legislation. We really are entering a transformative time. If we're going ahead with climate change legislation, we're going to be ending 200 years of reliance on fossil fuels that build our economy. We can do it, but we really need major, major game changers. For geothermal, believe it, or not, I want to start with transmission. John and I did not rehearse our comments, but on the federal level we need major changes in transmission. You know, if you've got a policy of encouraging the use of renewable energy, it sure helps to have a corollary policy of getting that renewable energy to market. And as we all know, whether it's geothermal or wind or solar, you can't build that in downtown LA. The solar in the Mojave is close to population loads, that's 100 miles. The geothermal in Imperial, whether it's east to Arizona, northeast to Las Vegas, northwest to LA or due west to San Diego, you're still dealing with about 100 miles plus. The transmission is critical. One idea to think about if we're really serious about developing renewables and we've got a lot of federal lands issues, those of you whether it's siting a power plant or dealing with transmission, whether it's the Forest Service, Fish and Wildlife, BLM, you've got a lot of alphabet soup federal agencies. What about one agency only like the FERC (Federal Energy Regulatory Commission) being the one stop siting authority for transmission lines over federal lands? Ideas like that are what we need. Or tax incentives, like extending the bonus depreciation for all renewable energy projects or transmission lines serving renewable energy placed in service over the next decade. We actually have a lower depreciation schedule in this country than most European countries have. So those are in one field of transmission, some policy issues to think about.

Let me turn to a second topic, it's become kind of a whipping boy, the production tax credit, what's going on there now. Wind has had a production tax credit for 16 years, off and on there's a lot of pressure on Capital Hill to say, okay, you've had it for 16 years, when are you going to enter the marketplace? Geothermal, we as an industry have had it for much less. Now there's a bifurcation developing with looking at a longer extension for geothermal, the folks in Washington get it, they understand the higher capital costs that we have and the longer construction lead times. The problem right now in DC, it's really kind of a political one. The Republicans kind of feel that they've gotten the public attention on this whole idea of more domestic energy production, and they don't want to let go of that and they don't want to deal with the extenders package which has the production tax credit in it right now.

And as only Washington can do, the 17 billion production tax credit extension bill has now been larded into a 123 billion dollar tax bill that's got a whole lot of other provisions designed to get more votes. It's not going right now and there's a huge debate over whether to pay for these tax extensions. The Democrats seeking to impose fiscal responsibility are demanding a "pay go". In other words, if you have a tax credit that's going to take money away from the treasury, then you need a revenue raiser or an offset (that's a euphemism for the word tax) to make up for that, and that's posing a huge problem. It's a little bit intellectually inconsistent because the 123 billion tax bill is about half paid for and half not. I don't know if that's going to get resolved any time soon. The Senate may accomplish something before it goes out for August, still got to go back to the House and under the Constitution; any revenue raiser has to start in the House anyway. I don't see it as a disaster if the PTC is not renewed this year because I see big Democratic gains in the Senate and the House. I think betting money would have a Democratic president, and I could see Congress early in January making the poster child for renewable energy development a three or five year PTC extension regardless of all this business about revenue raisers and offsets, so it could be a blessing in disguise. That's the PTC problem. You know, you can take what I've said today, and you can throw it out the window next week. We'll see where that one goes. And it's also a terrific fund raiser for Congressmen wanting to run for reelection, so that short PTC extension can also play other ways.

Third area – these thoughts come from listening to the previous panel and to John speak. I think this really is the biggest area, which is the federal R&D. It ties directly into climate change. I honestly feel that a cap and trade system for climate change is virtually immaterial without the functional technology to implement it. You can't trade anything today if we had cap and trade legislation because we don't have the carbon capture and sequestration, we don't have the IGCC, and we don't have the widespread use of renewables. What's there to trade? Nothing. It's cap and pray. Or maybe what you need is cap and tax. But we don't have cap and trade and we're not going to have it until we have the technology.

And regulating carbon before the technologies are available I think is unwise. It's certainly going to be expensive. What do we need? We need a massive Apollo type program, which is a major long term funding program. I think it's got to be a public and private program, in other words, I think there's got to be a surcharge on all utilities in the United States, meaning customers, to go into an R&D program.

You can't rely on Congress for the steady stream of appropriations. Like it or not, look at Future Gen. This was going to be you know the great white hope of coal, which was funded for what, two years and now it's all gone. When you're dealing with the vicissitudes of Congressional

appropriators and a year to year appropriation process, you're not going to get there. You've got to fund this R&D; it's got to be massive. The analogy to the Apollo Program is good because John Kennedy said that we need seven to nine billion dollars to get a man to the moon by the end of the decade. And if we're going to do it, you've got to commit to it now and you've got to pay for it. That's the idea and that's why I've been calling it an Apollo Program. Get the money and start with the geothermal R&D now, which by the way, that would be about 60 billion today.

I'm delighted Ed's coming in when he is. We were dealing with zero appropriations for a couple of years out of the Bush Administration, now it's up to 20 million. Federal R&D funding, in general, is down 85% since the 1970s, so I think massive R&D funding is another major policy area. What does this mean for geothermal? Well, implementing part of last year's energy bill, the Advanced Geothermal Energy Research and Development Act that actually calls for 95 million a year in R&D programs. And it could well be when you look at the map of the United States, that advanced geothermal has a better chance than putting in 120,000 miles of pipelines for CO₂. As far as areas of research, you folks out here know a lot better than I do where that money should go. I would call for a cornucopia use of those funds. For geo-pressurized resource production that's produced in oil and gas fields. Cost share for drilling that Ed Wall mentioned earlier, that's absolutely critical. Pairing the federal government with geothermal developers to deal with the single biggest risk and the up-front risk is a good idea, and I would say improving the drilling precision, that's needed. Funding, of course, for enhanced geothermal and other areas that are called for. Loan guarantees can also be an important part of that R&D. Big bucks is what's needed, and it's needed for the long term by imposing one-tenth of one cent, one mil surcharge on the average consumer bill. With that you can raise about two billion dollars annually just from the private sector. Match that with the federal government, you've got a decent R&D program.

And then lastly, a fourth policy area, a federal renewable portfolio standard. I would strongly vote no on that one as a way to go, although the wind industry is pushing it very hard. I just think it's a politically heavy lift in Washington. States that don't have the resources call it a transfer of wealth from the California's of this world, and frankly, the states that have the resources have their RPS's in place. The count's now up to about 27 or 28 states.

But there are a lot of policy initiatives. I really think that if we are looking ahead at a world of pricing carbon, of dealing with our carbon challenge, the future for geothermal is limitless, and that's where that major R&D is should be. Karl, you want to open it up to questions?

Karl:

I'm sure somebody must have a question here for Jonathan or John.

Jim Lovekin, GeothermEx:

Discussion about potential for cost shared drilling, supporting the drilling aspect of it, which is, of course, one of the major hurdles, one of the costs the developer has to deal with. It might be wise this round, maybe better than was done in the 1980's cost share program, to link the availability of funds for cost share to the data that comes out of it.

You've got to realize that a lot of this drilling's going to happen on leases that the developer is already committed to, it's not like you're just going to go out anywhere and drill. Someone has to have locked it up so they have some prospect of getting a profit out of it, but if they've locked up the acreage then it's not clear what would really be the downside of having data. If they're getting funding to assist with the drilling, it would be good to have some of the results of that drilling, both in terms of temperatures and flow rates to assist in this database that's been talked about in the plan put forth by the California Geothermal Energy Collaborative. This would be something that you could use to actually put some meat on the bones, whereas what we're trying to do now is ferret through a lot of 20 year old data that was not very well documented at the time. So I just think that that linkage that might be useful in terms of understanding the resources of the state.

Weisgall:

I think that's a good point. I would only add that you've highlighted one of the problems with some of the R&D funding is the proprietary issues that go along with it, and you've got developers or utilities that are so reluctant to open anything that's deemed proprietary, and that remains a huge challenge. If geothermal is to reach the potential that we know it has, I think ideas like your suggestion; we're going to have to go that way.

Karl:

Question?

James Harter, BLM, California State Office:

This question is for Mr. Weisgall. You identified transmission issues as among the key issues to focus on for the future for the energy industry. As a federal land manager, the place that transmission is often focused on is federal land. We are stuck between a rock and a hard place in facilitating energy development. There are significant resources available, but we also have significant resources related to endangered species and cultural concerns. The American Wind Energy Association has proposed a significant initiative for transmission in the West and creating an interstate transmission grid, direct current transmission grid. What role do you see technology and new initiatives focused on support from geothermal, these collaboratives that we've been discussing this morning in perhaps creating this new paradigm for energy transmission in the West?

Weisgall:

First of all, let me begin with the concept of the DC line. You know, that's great, but the problems it can cause from a policy point of view is kind of staggering. If you've got a DC line that's going to go from Utah across to California, but Nevada will get absolutely no benefit whatsoever because it's a DC line and there's no drop off, as opposed to an AC line - that causes huge policy problems. That's one answer.

Second answer, WEA has made some very good proposals. You've got the Western Governors' Association looking at western renewable energy zones. You've got, in Texas you've got the CREZ, the Competitive Renewable Energy Zone concept. In California, you've got RETI, the

Renewable Energy Transmission Initiative. There was an interesting article in last week's California Energy Markets. It listed seventeen separate initiatives in the West with seventeen separate groups to study transmission.

As part of another platform in my company, Mid-American Energy Holdings Company, we simply bit the bullet. We're going ahead with what is a six billion transmission project. We've started. It doesn't take a rocket scientist to take a map like the National Renewable Energy Lab map of the West and overlay that on the best renewable resources. That's what we did. By the way, you're absolutely right; a lot of it goes over federal lands. We all know where it's needed. We know it's for Tehachapi, we know it's for Imperial. Now, whether that's the Green Path or the Sunrise Power Link - that is up to policymakers and regulators and the political process, but we know where it's needed.

As a company, we're looking at huge increases in native load in Salt Lake City. We've got to deal with our customers and we want to move the wind out of Wyoming, so we started. And, one thing we're seeing is we're dealing with eight separate regional BLM offices and now we're seeing some very good progress. We're seeing one national coordinator of eight separate offices, and that will reduce some of the inconsistency in policy. There is increased recognition in the federal government that it can't be business as usual any longer, and the BLM is catching up very well and coordinating. So I'm not a great believer in study groups, and I apologize if I'm stepping on toes about not needing more initiatives, but we know where that transmission is needed and the question is getting the capital out there to build it and getting the right incentives, the right profit motives, the right partners, because in the West those transmission lines are going to be carrying renewables and natural gas for the next couple of decades. They're not going to be taking coal, and I don't see a whole lot of nuclear developing in the West.

White:

I'd like to add a somewhat different point of view on that question. First of all, I actually think the collaboratives are important because the utilities on their own have a remarkable capacity for self-inflicted wounds. Witness the extraordinary amount of money that San Diego Gas and Electric has spent trying to build a poor idea of a transmission line through a state park and refusing to develop the alternatives until after they'd spent a hundred million dollars. I understand that some people might think that's a close call,

We struggle to build consensus with the environmental community where we can, and there is a center that's fragile but it's holding. It's holding around the idea of developing needed transmission in certain corridors. I actually think the solar development with BLM is an example where a collaborative approach between the state and the federal government is going to be essential, because the BLM can not handle the wildlife mitigation on its own. It needs a state partner or else it's going to end up excluding a lot of areas, because the military's already spoken up and took over a lot of land that would otherwise be available for solar.

I also think that new technologies, particularly the DC light technology that ABB and Siemens are both pioneering may have some opportunities in some critical areas such as the Green Path North line that runs up from Imperial to LA. There's going to be a big fight with local elected officials over going through the Morongo Basin. It would be good if we can underground part of that line, which you could do if it was DC line.

So we have to be open to new technologies. And while I agree with Jonathan that this isn't as complicated as sometimes we make it, since the resources areas are known and the basic corridors are also known. There is some work to do; and unless we're going to have a dictatorship of the bureaucracy, we're going to have to find a way to get people on the same page. Some of the collaborative work that goes on is part of that. I also think that it's got to have a greater sense of urgency, and it's got to be inclusive.

For example, the Western Governors' Association renewable energy transmission work is very important, but it's got to involve the states. One of the things I worry about is that the DOE is just going to jam this through because the Bush people want to say they did something before they left, and in the end they're going to maybe leave us worse off if we're not careful. So I think we've got to really work together. I also think that Jonathan's right; we need a sense of urgency. We need to recognize that if we're going to meet both our energy needs and our climate goals that we're going to have to act more quickly than we have been capable of acting in the past. And I think that that's going to take collaboration and it's going to take leadership. One of the things the governor could do that would really be helpful is show up to the Western Governors' Association and participate in some of these forums. I think if he got together with some of his other colleagues like Freudenthal and got behind an agenda, we could move the federal government in the first 100 days regardless of who is president.

Weisgall:

I listened to John, and I'd like to take a page from his playbook. Who should be there supporting these transmission lines? As a company, we have decided to reach out to NRDC, Sierra Club, Union of Concerned Scientists, and the Nature Conservancy and say, folks; you're the ones who want renewable energy resources used. We need you to help us figure out how to build these transmission lines. We want to avoid the mistakes that others have made and there's a lot to be learned from those mistakes. The need to bring together the renewable energy developers and the environmental community is absolutely critical.

Karl:

Thank you, John, thank you, Jonathan. This was great.

Session 3 - Moderated Discussion: Perspectives on Geothermal R&D Priorities for California

Gawell:

The next session will be a discussion lead by Mack Kennedy and Carol Bruton. Let's start the next issue. I want to introduce Carol Bruton, from Simbol Mining Company, and Mack Kennedy from Lawrence Berkeley National Labs to begin a discussion and facilitate building on our earlier panels about R&D, particularly as it relates to California.

Bruton:

You saw this chart during Bill Glassley's talk, and you can see there's a huge gap between where we are now and where we need to get in the future. What we've been asked today to do is start getting the input from the stakeholders on what geothermal research is needed to help us achieve these goals. If you look at the map at our existing development, we've got around 2,500 megawatts installed. Various estimates show that there's potential up to 25,000 megawatts, and just for reference, that's twice the amount of megawatts needed to meet our RPS goals for 2020. The question is can we get it in a reasonable amount of time, and what research do we need to get there?

It's a little bit difficult to do this for California, because our resources are so different, and there are a number of problems we have to address. Paul Brophy and Matt Kennedy last year said, look at our types of geothermal. We've got steam fields, we've got volcanic centers, and we've got the Imperial Valley, which is unique unto itself. Not only do we have these high temperature systems, but we've got moderate and lower temperature systems that we can bring onto the grid. So we've got both the technology and problems associated with flash and binary plants and also the ground source heat pumps which will be talked about this afternoon.

And for the future, which DOE is beginning to focus on, is enhanced geothermal systems. You need heat, you need permeability, and you need water for any EGS systems. One R&D questions is can we artificially create the permeability or use another working fluid, which is supercritical CO₂ or another source of water.

There is also an interesting potential using oil and gas wells. As a general rule, for every barrel of oil you produce, you produce ten barrels of water which have tremendous energy content in them that we might be able to produce. So if we try to group the R&D areas, we can look at the areas of exploration, drilling, energy conversion, and operations and maintenance once you've got the system going.

Previous California Geothermal Energy Collaborative meetings have begun to identify some of these impediments at a very high level. For example, at last year's Development Plan Workshop, it was the wide variety of the resource types, the uncertainty about the character and the magnitude of the resource base. What do we actually have in California? We know it's a lot but we don't know much about it. There's a tremendously high cost of exploring for hidden and low temperature resources. Not only the high cost, but our resource technologies aren't that specific to pinpoint these hidden systems. Also the high cost of drilling, and finally, it used to be the limited number of exploration entities, but that's increasing, so I'm not sure that's as a big deal these days as it was when we talked about it last year.

Some of the technical needs listed in the development plan in your packet shows our need for a clear understanding of these resource types, including their geologic and structural settings. This is what Monastero would call a resource assessment model where basically you give a conceptual model for a system so people will be better able to develop exploration plans if they know what type of system is in a particular area.

Everyone's talking about the need for R&D funding for exploration tools. We need some more knowledge of what geothermal systems are in California put these into maps that identify lands with the potential for producing fluids. And these are fluids, whether it be high temperature,

medium temperature, low temperature, or geothermal heat pumps. Because that's something you could take to your investor and say, listen, there's a resource here. Let me tell you where I can pinpoint in this area to go get it. And there are distributed generation systems and R&D for generation systems using low and moderate temperatures resources, and we'll talk about those a little bit later.

What I want to do today is to take some of these research needs and define them in more detail, getting specific about what we need to do to develop these resources in California via this open discussion. We are going to take your views and assemble them, continue to grab more data, and transfer this information to the California Energy Commission to inform them what the needs are to help them guide future solicitation in the future.

So how are we going to start discussion? What I've done for each of these areas is made a list of our perspectives on what R&D needs are to get your feedback. I've cut it into two areas. One is the development of conceptual models and data and the other one is on exploration tools.

For conceptual models and data, the first concept of what came out of the development plan last year is developing a clear understanding of all resource types including their geologic and structural studies. Basically if we get conceptual models that means it'll help the developer determine what exploration technologies might be useful in exploring for that resource. And then putting all this information onto maps that we've talked about earlier. Ed, I think you mentioned a compilation of known data and case histories. Everyone has had experiences, but all the data is scattered all over the place. If we could gather all the exploration data that we have, whether it be data from oil and gas wells or previous exploration efforts, and put it in a central database accessible to everyone that would be helpful to the industry as a whole. Also we should include detailed case histories in it to serve as exploration models; like GEA has done with Blue Mountain exploration effort, they've really detailed that in their latest report, which I think is great. And something that I think is important is data fusion techniques, is integrated modeling and analysis techniques. We're not just going to take a given data set from seismic and say what that says about the system, but take your seismic data and combine it with your electrical resistivity data and all your geologic data and come up with a conceptual model of the system that fits all three data sets rather than each one individually.

Comment:

You know, I would see the linkage if there's to be cost share drilling there should be data coming out of it and maybe some thought given in advance to what the format of that data submittal should be and then there should be some system, rather than just going into people's garages and bankers boxes withering away in some storeroom someplace, there needs to be some way of following up on it.

Bruton:

What about data integration?

Gawell:

Let me make a question about the issue. What you're doing is trying to develop these maps. I made the comment at the workshop in New York that you've seen the evolution of geothermal maps. The ones from twenty years ago were really just the rift and then we started finding Nevada has resources, so it kind of smeared the rift into Nevada. And the latest maps, which kind of smeared the Italian plates up into other areas. The point is we're now going from volcanic systems, which is how we had defined risk to all these non-volcanic areas. I just mentioned to Paul, the DOE's talking about a demonstration in Florida, and that wasn't on the map at all.

Our maps aren't keeping up with our thinking about how the resource base can be used. It will be important when you develop this that you don't just develop it with the concept of conventional hydrothermal systems. That you look at the full range, including for example, one Bill Glassley and I used to muse about, the Chena project. How many small power projects could we site in California in areas where people would leave them off the map because they would say, well, you could never do a utility scale project there. So things are changing, and I think as you look at your exploration R&D model you've got to be also keeping in mind that we need to be looking for the broader range of applications and technologies. I do think new maps are important, in fact, that's why Google gave a half a million dollar grant to SMU to update its heat flow maps. Google had asked me, what maps could we show for geothermal? And I said that there aren't very many good ones. He said, "We like these SMU maps, they're really interesting." I said that those SMU maps have very limited data flow. I understand that they really haven't done heat flow mapping in California effectively in any systematic way. I think they have four data points in California. Kentucky has zero. So Kentucky's cold.

Bruton:

I think Alaska has one.

Gawell:

Alaska has one, so there's millions of additional information that's come in since they developed that. So just update what even basic heat flow looks like, there's a lot of work to do here but it's got to also involve opening up our minds to think about the variety of geothermal resources.

Bruton:

USGS is doing a national resource assessment, but we need more detail for California including some of the lower juncture resources they may not.

Gawell:

From what I've seen from Colin at USGS, they are still looking at medium and high temperature in a relatively conventional use. They're not getting into EGS in any big way; they didn't seem to be doing small scale. What's the difference between understanding the geology for direct use in power production? I mean, they're shades of different gray - they're not black and white. So I think we have to look at things a little differently.

Kennedy:

I think I can add to that. We are looking at that. The idea of these maps is to assess what the potential of geothermal energy is in California. That third slide that Carol showed, we have 2,500 megawatts online, a thousand or so from two years ago I guess, with a thousand sort of coming online, but the estimates for California are from 3 to 25,000 megawatts. Three doesn't do much, so we need to figure out what that real assessment is on a very high resolution scale. Not just for the conventional stuff, but for all temperatures and all uses. And for systems like ground source heat pumps we may have to add a climate curve. Surface temperatures are going to be important in the efficiency. Same thing for moderate to low temperature hydrothermals.

Glassley:

Something else that I think would be worth considering. When the USGS does their oil and gas assessments and publish them annually, they have a risk approach where they evaluate the data that is available. They have a standardized data input process, and they run it through a well established model for coming up with what the risk is for various sized resource in a given area. We need to be thinking in terms of something like that where we have a much more consistent way of looking at these resources and modeling them in a risk way along the lines of what the USGS has done. It would be more useful, especially when one goes out and tries to find financing for various projects. And it would make use of the data we would be generating in a smart way, but it also would help inform us of the kind of data we need to be collecting in a consistent way around the state.

Lovekin:

I have to say when I see estimates in the 3,000 to 25,000 megawatt range; the upper end of that range I don't think has any traction. Depending on what forum, there's a certain giggle factor that you get into when the numbers get really big. I agree with what Bill was saying in terms of some sort of a methodology that could weigh risk. Folks in the room probably familiar with the 2004 vintage CEC PIER report that my company was involved with, but it did just that, it gave probabilities based entirely on heat in place, but not all megawatt estimates were created equal. It gives you a spectrum of things with 90%, 50%, 10%. If you want really big numbers at a 1% probability, I'm not sure that gives you much traction. So I think it is important to define terms and be careful about going around huge numbers that we're going to have to live up to. If people come and say, where are you going to put your transmission lines? And you say we've got 25,000 megawatts maybe. We'll hear more about it this afternoon for the RETI process, listing credible numbers that utilities can listen to and really believe. And yes, it is focused on conventional hydrothermal, but that's sort of what we're seeing for the next ten years as far as where we'd like to go forward in the near term. So just be careful with the big numbers.

Kennedy:

Couldn't have said it better myself.

Carter:

A couple of things occur to me, on where to focus on R&D I think we should go back to the lists that have been developed in the last five or ten years and use those because there was no money to follow through on any of those ideas. People gave a lot of thought to those lists, and they already exist. On the mapping, one thing I've noticed is the maps do get better. They are more attractive to people who are looking at the geothermal. However, it's really important to explain, for public information, exactly what those maps mean and don't mean and what would be involved in following through in the use of any map in the vein of what Jim Lovekin was saying. I know I'm not the only consultant who's been receiving expressions of interest from people in this country and other countries who want to get involved in geothermal energy. They look at these new maps, and they have no clue what's involved. I know this discussion is on R&D, but it seems to me that focusing on assisting the industry with some kind of better access and an incentive, that you would be getting people out there doing the things that you're planning to do with this mapping, with discovering new resources.

Schochet:

I'm Dan Schochet. I raised a question ten years ago when I went to one of DOE program reviews in Berkeley that Allan ran so well. With my background as an engineer in development, I tend to be simplistic. There's a huge amount of data that's been acquired through geophysics, seismic data and other stuff. And from what I have seen of the people interpreting the data, it's become almost a fine art to take a look at the plots that look like an MRI of somebody's brain and turn it into a geological model. There's also been a large amount of drilling on many of these same resource areas where the geophysics are. We need to take a hard look at the interpretation of the geophysical data taken on the surface and the actual results of drilling in many of the cases. Could we use additional funds that could be modest or extensive to be spent on trying to refine the models so that using of course the geological data and the geological models as well as the geophysics, so we can make better use of surface acquired data to reduce the cost and the risk of drilling, both exploratory drilling and actual well field production? So, Carol, is that something that could be factored into the future R&D?

Bruton:

Yes, it is something to take a look at.

Everyone says that we need improved exploration tools, especially for the systems that do not have surface expression. During the last workshop someone mentioned that we need to find out what's in the Central Valley. It's got a huge sediment cover, so we can't tell what's underneath there. We probably need a brand new exploration tool for that area.

Something that came out of the EGS meetings, do we have tools for subsurface permeability imaging, for imaging fluid flow, and even on surface tools and tools in the well. Improved satellite imaging, and we need improved resolution for any tool, whether it be the geophysical tools and geologic, but it's data integration because some of the satellite imaging, you can get GPS data, geodetic data, well combine that with the satellite data that gives you the thermal infrared satellites, you get temperature data at the same time. Mack's been working on the helium isotope to detect zones of permeability. We need new geochemical and geothermometers we could use that would decrease in noise and increase in their resolution of geophysical surveys. So again this is nothing new. Do you have an idea about priorities? Do you think

improving the existing tools is going to be worthwhile or do we just need to do some a totally new tool? Any comments about exploration tools, what you find useful? Dan, what you were saying about how the existing tool's been used to prove out in the drilling, we should do that study.

Gawell:

Drilling came up before but I would pleased to see comments in our report about subsurface technology that drilling smarter is important and this is all about that. Add this to your environmental issues. I mean, putting a drill rig out on public lands, how many permits can we do? If you can do things smarter it has multiple benefits in terms of what you're going to be able to do.

Bruton:

Drilling R&D, that was the next issue I was going to bring up, is putting your wells in the right place. That's the best thing you can do, but there's other technology, maybe improvements you can do to reduce the cost of drilling. And I'm not sure if that's something that the state could emphasize. I was curious about what do you think development of microphone technology would be good for doing some shallow grading holes, the temperature testing, things like that. Improved well design, standard zonal isolation. Studies on zonal isolation diagnostic well drilling are actually being covered in the DOE geothermal program.

The next area is operations and management R&D. How would you prioritize these technologies? Improved tracers, electrical submersible pumps, management of induced seismicity, that's a really important environmental concern, because we start putting geothermal more places we're probably going to have more induced seismicity, which is an environmental and public acceptance issue. We're going to need stimulation techniques just like they use in EGS. Continuous downhole measurements, alien corrosion control. And one thing I think is going to be important for the state is water availability. We have existing geothermal systems in California that are running out of water. The last thing people want to know, if they have geothermal development in the backyard, is if we require more water. That's going to be a problem, because water is in high demand in California. So I think that's something that maybe the Collaborative should be looking at. Do you think water's going to be an issue in California for geothermal?

Kennedy:

Yes.

Bruton:

Okay, good.

Gawell:

Carol, let me make a note on this, because this also came up in the last few days. I mean, this new Advanced Research Act says that one of the DOE's priorities among the litany is improving environmental performance of geothermal systems. We have to look at what are the thing that

come up all the time. Seismicity comes up all the time, and water consumption and the cooling systems come up all the time. The idea of having much more efficient cooling systems not only addresses the water consumption, also addresses reservoir sustainability and it reduces our limited emissions because most of our emissions are coming out of those cooling towers. So I think that ought to be an area that has some sort of priority to it.

Bruton:

We know we're going to act as lower temperature resources, but unless our energy conversion systems are more efficient, better cooling systems, we're not going to be able to make energy economically. One of the EGS slides said that a lot of EGS research is going on at DOE, which will help hydrothermal, high and low temperature development, but may not help us on the time scale we need to get development in the next few years, but it's something we'll be able to draw upon. And one thing, oil and gas co-production. We don't have a good survey of the temperature and the chemical characteristics of the fluids that are coming out of oil and gas wells in California. So I would recommend we do a survey through the Collaborative of the geothermal potential of oil and gas wells in California. It's sort of something new.

Kennedy:

Let me add something. We've only got a couple of minutes left before lunch, but one thing we want to point out is that this PowerPoint will be on the CGEC website. So we would like you to view it, make comments and send them to us, because right now it looks kind of like a catch-all wish list, but these are the things that the State of California need to be focusing on to get to 20% by 2010. Yes.

Question #1:

Carol, if you could go back to one of your slides, that one right there. A few years ago we gave up the term geothermal heat pumps and the engineers named them ground source heat pumps and I think we need very badly to go back to geothermal heat pumps so that every time somebody downloads one of these slides or one of these presentations, they see the word geothermal. There are still people that think that ground source heat pumps are solar energy.

Bruton:

Good, great suggestion. I'll start with that before it goes on the web.

Question 2:

Yeah, on to that point, I couldn't disagree more. I do business development for ground source heat pumps. I spend the first three minutes separating ground source heat pump technology from geothermal energy technology and I'd rather save that time because if I multiply that by 100,000 it adds up. I mean, it's the...

Bruton:

Why do you say that?

Question 2a:

Well because people get confused with geothermal and ground source heat pumps. They think that it's all about heat, they don't consider cooling.

Bruton:

So isn't that the problem with heat pump?

Question 2b:

Well maybe we should call them cool pumps too; maybe we should look at the whole name. It's nice to have people thinking about geothermal, and that's another matter, but to have them confused with heat pump mechanics is kind of frankly a waste of time.

Question/Comment 3:

In central and eastern United States, they're called geothermal heat pumps in those areas.

Kennedy:

Are there maps on ground source geothermal heat pumps, and if so, would a feasibility map identifying these regions where you can buy these and at what efficiency? And what kind of resolution is that for us in California?

Gawell:

Yes, but I heard a department official who will remain unnamed at sort of the assistant secretary level say in a meeting that the reason there weren't geothermal heat pumps or ground source heat pumps in California was because it didn't have enough cooling season and the ground wasn't the right type. Ground source heat pumps seem to get dropped out of a lot of programs for California, and I do think a lot of people think they just don't work here.

Bruton:

Especially when they say it's related to the water table. There's a lot of misinformation and lack of information like you just mentioned.

Fischette:

To add to that, the people in the industry, IGSHPA (International Ground Source Heat Pump Association) and the Geothermal Heat Pump Consortium have come up with Geoexchange which is a third name for ground source or geothermal heat pumps. We need to develop terminology that we can all use and not have to go through the whole list. We need a consensus, and that something that we should be working on.

Kennedy:

Maybe one solution to this and I'll throw this out, it's not just for ground source heat pump but in geothermal in general, traveling around the country, flying on the planes I use that time to read magazines and catch up with science and nature. And one journal I've been reading all my life is Scientific American. One, because I can read stuff about fields I know absolutely nothing about and actually get maybe 1% of the information out of the article. But I've noticed that there are ads in those magazines for solar, wind, but I've never seen one for geothermal. Never. That'd be a good place to explain what a geothermal heat pump is, an ad. Let people know what it is.

Nemzer:

Hi I'm Marilyn Nemzer from the Geothermal Education Office. Anyone in this room who's interested in geothermal heat pump conversation, I would like to make sure I have your name before you leave today. The conversation we're having now is really important, and it merits more time. The difference about what we call it does seem like a conflict, but we need to deal with it and I know we don't have time today.

Koch:

Chip Koch, independent consultant. I've been looking at ground source heat pumps, geothermal heat pumps, Geoexchange or whatever you want to call it. There is definitely a problem in the industry on what to call it, but what I've also found is there are very few good case studies that really are more scientific in terms of how a good data is presented. We could really use some. Fort Polk is the one study that's used over and over again. Dan Ellis presented a paper in Zurich this year where they really did a good job with Oak Ridge National Labs in presenting data from a Habitat for Humanity project that they did. But in general, I've found out is that there's a real dearth of information that demonstrates how well these heat pumps work in terms of reducing electricity and natural gas as well as savings of greenhouse gases. When I talk to people at CEC or PG&E they want to know about how much GHG, or what the CO₂ footprint reduction would be. That's what's really impressive, and so we need to be able to do that.

Bruton:

In closing... we're just starting this process so we really want your input and we'll be working on this the next few months, but let me ask you something. We mentioned these different areas in a little box diagram, so if you could jot down any of your thoughts about a high priority items, and please give it to Mack and I anytime today. Thank you very much.

Gawell:

Real quick note, Lunch is served on the terrace and we'll be back here at 1 o'clock sharp.

Break for Networking Lunch

Keynote Speakers: Deputy Secretary Eileen Wenger Tutt, Climate Change and Environmental Justice, CalEPA and Commissioner Karen Douglas, California Energy Commission

McCaull:

We're going to get started with our keynote speakers. Good afternoon everyone, my name is John McCaull, I work for the Geothermal Energy Association as their Western States Representative, and I'm going to introduce both of the keynote speakers today. We're going to start with Eileen Wenger-Tutt, who is the Deputy Secretary for Climate Change and Environmental Justice at Cal EPA. Eileen has been working in state government for 18 years and has been working in and around the issues that we're going to talk about today related to climate change. She's done a lot of work on transportation and fuels and mobile source issues, including the hydrogen highway. I've had the opportunity to see her and her team, that Secretary Linda Adams put together, who works very closely with Mary Nichols in the Air Resources Board who are really on point to implement AB32. The team that's been put together in state government around implementing AB32 is outstanding and we're very appreciative. We are very lucky to have Eileen here. So she's going deliver her comments, then we'll have a question and answer period, and then Commissioner Karen Douglas from the Energy Commission will come up after that. Thank you.

Wenger-Tutt:

Thank you. It is really a pleasure to be here today. I learned so much at lunch. I had a number of questions, and it was fascinating to talk to people, because not one of my questions had one answer. One thing that was clear is that geothermal is an incredibly complex sector politically, economically and even technically. So in terms of full disclosure, I am not an electricity sector specialist. I oversee the climate change effort under Cal EPA for all of state government because Cal EPA (California Environmental Protection Agency) coordinates climate in the state. I am here today to talk about AB32, the Global Warming Solutions Act, including our scoping plan that we recently released, and how this connects with our Renewable Portfolio Standard.

In terms of background on the scoping plan, AB32 requires the Air Resources Board to create a scoping plan, but there is no way that the Air Resources Board alone can either create the scoping plan or implement the programs needed to meet our 1990 by 2020 goal. And just a couple weeks ago when the U.S. EPA and the Bush Administration announced that it is going to do absolutely nothing to combat climate change during the Bush Administration, I will say that although I was somewhat surprised, it made me really proud to be here in California. I personally work with many people from the US EPA and I find them a pleasure to work with, and members of the Department of Energy, but I will say that here in California we have a governor, a legislature, and we have industries and a general population that demands that we take leadership in combating climate change. So it feels really good to be here.

The first step in AB32 is to develop this scoping plan, which has to be finalized by January 1, 2009. It sets an overall plan of action for how California's going to get to this 1990 emissions level by 2020, and it's very complex. The 1990 level represents about a 25-30% reduction in emissions beyond business as usual, and a reduction of about 170 million metric tons. It's extremely ambitious, especially when you consider that California is on the leading edge of

many technology and green policy movements, and so we are setting a goal for ourselves to go even further.

There are a number of key recommendations, and the first is that we have to implement the programs that we already have in place. For instance, we have a vehicle standard that is tremendously aggressive and will require cleaner cars in California over the next 5-6 years as we implement our Clean Cars Program. We also of course have our Renewable Portfolio Standard, which is quite progressive. So these need to be implemented. We need to expand our energy efficiency goals, and that's going to provide tremendous emission reduction benefits as well as cost savings. We have recommended that we expand the renewable portfolio standard here in California to 33% by 2020.

And then finally, the scoping plan says that we need a cap and trade program. The cap and trade program is not a substitute for our regulations, our incentives programs. It is intended to be one tool in our portfolio to meet our ambitious greenhouse gas reduction goals. The way the scoping plan has laid out the cap and trade program is that it would cover the cap; there would be a cap on basically emission sources that make up about 85% of the greenhouse gas pollutants in the state of California. So the cap is multi-sector, it's very broad. The sectors that are currently recommended to be covered under the cap are transportation, which is the largest source of emissions in the state, and then electricity including commercial and residential and large industrial sources.

The scoping plan also recommends that the cap and trade program be developed so it can link up with the Western Climate Initiative effort which is underway. The Western Climate Initiative is a group of western states, there are seven states and four Canadian provinces, who have agreed to work together to create a robust cap and trade program that will provide significant emission reductions in the west. And the Air Resources Board recognizes that the most effective cap and trade program will be regional, it will not be just one state. And by effective I don't just mean cost reduction, I also mean getting the most emission reductions possible. In the world of global warming, it doesn't matter if the ton is emitted in Utah or New Mexico or British Columbia, every ton reduced benefits California's natural resources and our public health. So we need to work together in a new way, in a more aggressive way, to encourage other places in our region, in our nation, and around the world to take action to reduce emissions.

So in terms of process, the draft plan was released on June 26th. The one piece that's still missing, and it's very significant, is we have not completed the economic analysis. It's incredibly complicated to do an economic analysis for a plan this complex, but we do hope to get that economic analysis out in the next couple of weeks. Right now we're in a comment period on the draft plan, so we would welcome your comments, and we do plan to release the final draft in early October. After the final draft goes out for comment, the Air Resources Board will consider that final draft in its November board meeting, and hopefully will adopt it. Then the work begins. Then the state government and all of us working together will begin implement the programs that are recommended in the scoping plan. We have until January 1, 2011 to basically develop the regulations or the incentive programs or the cap and trade or other market programs that are included in the final now scoping plan. Once we develop those programs, we have one year until January 1, 2012, before they are supposed to be operational California statute.

So in terms of the Renewable Portfolio Standard and how it fits in to all of this, renewables as you know, are currently at about 12% of the electricity generation in California. We have a 20% RPS for 2010, so we have a long ways to go in the next year and four months, and it's going to be a challenge. We've been working with some of you, and stakeholders in general, in the electricity sector to figure out how we meet that challenge because we do want to expand the RPS to 33% by 2020. If there are barriers to be overcome for the 2010 goals, then those same barriers will prevent us from meeting the 33% goal. So we have to remove the barriers where possible or find other ways to make sure that we do meet our RPS target. Now the 33% that's recommended in the scoping plan is applicable to all load serving entities so we don't have this separation that we currently have between the investor-owned utilities and the municipal-owned utilities and others. So we're looking at all load serving entities being covered by this 33%. To give you some perspective on what that means in terms of emission reductions, it's incredibly important that we meet the 33% goal because it provides over a 21 million metric tons of emission reductions in the 2020 timeframe. There's only two other programs in the scoping plan that provide more emissions reductions than the 33% RPS and that's our vehicle standards and the cap and trade program. So the RPS is a significant part of the plan for California.

Now I'm not an expert on the challenges around meeting the RPS, but I've sat through a number of meetings, and even just at lunch I was fascinated by the discussion. There are clearly certain process challenges and by that I mean, the type of code for the pricing structure that we have in place for evaluating projects coming up into the queue probably at least needs to be evaluated. There are permitting difficulties obviously, and that for me is a sensitive area, because we need to work on the permitting issues, however, we have improved the air quality in the state, protected our natural resources to an incredible degree despite an increasing population and an increasing economy in part because our permitting and rules process is daunting at times. So we want to walk a fine line there to sure that we're not stopping projects that we know are good, but we are still protecting our environment and our air quality.

There are also transmission and distribution issues, and I know you have folks here who are helping to deal with those. Just from an economic perspective, the renewable energy sector is very important, because as you all may know - per megawatt hour - renewable energy provides more jobs than fossil fuel energy or electricity. And those are green jobs and we want green jobs in California. What I've seen over the last ten years is that the kids that are coming out of college, whether it be community college where they're trained professionals or our Ivy league colleges, they want to work for corporations and industries that are green and government agencies that are green. They care in a way that is profound to me, and it's really lovely to see. We have industries come to us and say we want the best and the brightest, and the best and the brightest want to work for green corporations, so what the heck do we do to get green? And that is like music to my ears. We do need to encourage renewable energy in the state and we need to do it because we're known for green tech jobs, and we want to draw those folks that are interested in that field to our state.

Some of you may know, we actually have a 2050 goal. The governor has set a goal of reaching 80% below 1990 emission levels by 2050. And when we set that goal, it was not based on what we thought we could achieve, we have absolutely no idea how we're going to get there. It was based on where the science tells us we have to be in order to protect the state against catastrophic climate change. So the governor said that he wanted the goal just to show how far we have to go if we want to protect the planet. When we start trying to wrap our arms around what that means,

it really means zero or near zero energy, whether it is transportation, electricity or heating, we've got to get down to near zero. That is why Cal EPA and the governor are champions of increasing the RPS to 33%, because it's a stepping stone that sets the tone for where we need to get in the future.

One of the first questions I asked Karl at lunch was what are the geothermal resources in California, and he said somewhere between 3,000 megawatts and 50,000 megawatts. I think that's a very interesting answer. I had actually a number which was given to me by my staff which is in that range, but what I'm going to say instead is that California has tremendous geothermal resources. And we need to maximize those resources not just because they're practically zero carbon, but because they're reliable. We can rely on geothermal resources basically 24 hours 7 days a week, which is not necessarily true of all renewables. I don't favor one over the other, I think we need them all, but I think geothermal is quite attractive and we certainly want to maximize it. I would like to see a geothermal plant because I haven't visited one, so I talked to our Calpine representative who's here and I'm really excited to visit a geothermal plant and intend to do that soon. With that I would like to open it up for questions.

Grogan:

Thank you. My name is Larry Grogan. I'm a Supervisor for Imperial County. You said that you'd like to do away with barriers, and one of the questions I have is that in the Imperial Valley we have a tremendous amount of undeveloped geothermal and also potential for solar. One of the issues we have is transmission, and yet the Sunrise Transmission Plan - the EIR that has been done - the very number one alternative to that transmission plan was a 600 megawatt natural gas plant in sight in San Diego County. How can you reconcile that as coming from the state of California?

Wenger-Tutt:

I'm going to pass it on to Commissioner Douglas who's up next and really much more qualified to answer that particular question.

Grogran:

But you see my point.

Wenger-Tutt:

I do. And clearly we do want to overcome the transmission barriers. They are very, very complicated and as Commissioner Douglas will attest, we've had a number of meetings in the governor's office because we recognize that we've got to do something to overcome these barriers and we've been working with the environmental community quite closely. Our goal is to come up with some way to overcome particularly that barrier, and to work within the environmental community and with the renewable energy community. I know John White has been a key player in helping us figure out how we make sure we're protecting the environment while also expanding our renewables.

Grogan:

A letter from your office saying that that alternative is not acceptable would certainly be a place to begin.

Wenger-Tutt:

Thank you.

Carter:

I just want to mention in the same vein as Larry Grogan's comments, when California allows natural gas plants to continue to be built, that's a fifty year decision. That means for fifty years we're going to have those natural gas plants running. We don't have natural gas resources to run those plants for fifty years, so that guarantees there's going to be huge pressure for liquefied natural gas facilities in the state or accessible to the state. And I don't understand that kind of thinking. Because if you're encouraging geothermal or any other renewables, then why not just say no more natural gas plants period. If that creates a difficulty in the state, it seems like that would be an impetus for people to make changes that they need to make, just like they make changes when the price of gasoline goes up. It seems to me that there really is no honest commitment to do a lot of renewables and it's not just a California issue. If there were an honest commitment and an honest recognition of the kind of consequences that we're going to face from global warming and from the peaking of oil and natural gas, then we would make real decisions like no more natural gas plants and creating guarantee access to markets for renewables and access to federal lands for geothermal development. There just doesn't seem to be a sense that people understand what we're faced with.

Wenger-Tutt:

Although I think our commitment to 33%, that was a heavy lift, and I want to say that we're always balancing between reliable energy in the state, and avoiding things like the electricity crisis and brownouts and blackouts, and moving towards a cleaner grid. It's not an easy juggling process. I think Commissioner Douglas is going to respond as well, but my sense is on all the issues around electricity, banning coal or banning natural gas that taking those kinds of actions are just tremendously difficult from a reliability perspective. Even our 20% RPS is quite aggressive but going to 33% is very aggressive, and there are many out there who will come out and oppose that, as we hold our scoping plan meetings and hearings. So for all of you who want us to do more, it is very helpful to come to our hearings and meetings to say that because the other side is much more vocal. So you too can help.

Munson:

I've Steve Munson, Vulcan Power. We have 340 megawatts of contracts and we have more contracts coming to serve California load from out of state. If you would go to the next transmission meeting and make it clear the governor's on the right track wanting RETI, the Renewable Energy Transmission Initiative process, with John McCaull as our geothermal representative in California, if that process comes to the selection of say five or six new renewable transmission upgrades approved, and they run 40 miles to a couple hundred miles each, you will have removed the primary barrier to really getting down the road toward the RPS.

If the RETI process comes to more bickering and goes into quarter one, two, or three next year, we will have missed another opportunity. We're rapidly getting to the point in the RPS where we're way behind. And it's transmission that is the primary hang up, in my opinion and in the opinion of some other developers. So if you could impress the governor with the need to stick with that plan and come with five or six new transmission upgrades late this year or early next, you will have removed the major barrier. Thank you.

Wenger-Tutt:

As far as the RETI proponents and advocates that serve on that task force - the governor and his staff has been talking to that group, and I think there's an understanding that is the mechanism that we need to overcome the transmission issue. We don't want to create another process, we want to use the one that's already been in place and they in my mind have done a good job. I know it's difficult, so bickering is a strong word, but just recognizing that these issues are so complicated and there's so much competition that we don't want to create something new but we also want to push on the RETI process a little bit so that it does provide us with the projects that make the most sense in the state.

McCaull:

I think we need to transition to Commissioner Douglas. Karen Douglas is the newest member of the Energy Commission as of February 2008. Karen took the attorney position on the Commission. As a Stanford Law graduate, Karen did a lot of work with one of the state-level leading environmental groups, Planning Conservation League, and then during AB32, she did work for environmental defense on AB32. She was one of the key people that helped put this groundbreaking law together.

Douglas:

Thank you very much, John for that introduction and for the invitation to be here today. I look forward to giving my take on some of the questions that Eileen got to field about specific energy issues. As John mentioned, I've been on the Commission now for about six months. I'm the presiding member of the Renewables Committee, I'm an associate member of the Siting Committing and of the Transportation Committee, so in particular I find that being on the Renewables Committee and the Siting Committee together is a really powerful and a really good combination. One of my primary interests at the Commission is in making California climate and energy policy real on the ground. So when we have the governor's office and Cal EPA and the scoping plan ARB calling on us to create 33% renewable energy by 2020, that's what we're trying to do. We're gearing up and working very hard to try to do that.

I wanted to try to provide some general thoughts on what I see as we approach and start thinking about 33% renewables. The first is that it is a high level of renewable energy, and it requires thinking a little differently about the entire electricity system or maybe very differently than we have in the past. The very framing of an RPS almost guarantees that what the person talking about the RPS, at least initially, is thinking about is a fossil fuel system into which we are trying to push a certain percentage of renewable energy and whether that's 8% or 10% or 20% or 33%.

One of the first issues that we're beginning to grapple with is that when you're getting to high numbers like 33% renewable energy, it's really hard to think that way. It's important for us to start thinking about the system that we're trying to build in this state, as one that is centered around renewable energy. Thirty-three percent is a milestone. We want to get to 33%; we want to get beyond 33%. So all types of renewable energy are important, wind is important, geothermal is important, solar is important, solar thermal, solar PV. However, what is the real potential in the state for generation of these different kinds of renewable energy, and how will they work together, and on what time frame do we really think we can get this development, and then what is the fossil fuel backup that we need? What is the appropriate fossil fuel portfolio that we need to integrate into the system to ensure that it continues to function reliably?

I'm going to address the question of the speaker who talked about natural gas plants and why are we still permitting natural gas plants. I will just point out that right now that 33% renewable energy means that 67% is something else, and that something else right now in the state of California is large hydro, which doesn't count under RPS, it's coal, and it's natural gas - not in that order. Even if we meet our aggressive 33% goals, we've got a significant portion of our portfolio as natural gas. This is fresh in my mind because I just got out of a very contentious Energy Commission business meeting where we extended the license of a very large natural gas power plant in the East Bay to give them two more years to commence construction. A number of opponents showed up, and a repeated argument that they raised with us is after the passage of AB32, how can you even think about permitting more natural gas? We should stop building natural gas. And I think there are a couple answers to that and one of them is that unless we get a commitment from the people of the state that they don't really want to use electricity, or they're willing to use it between the hours of eight at night and six or seven in the morning rather than when they're used to using it, we have to consider everything.

As long as we energy policy makers are held accountable to provide people a level of service that they expect, we need to find a way to provide this reliability. It's interesting because it's both a short term and a long term question. The short term is a really strong argument that when you build an efficient natural gas power plant, what you're doing is displacing the least efficient both economically and in terms of their consumption of natural gas and in terms of the criteria pollutions they produce, you're displacing much less efficient, older plants, in some cases allowing them to be taken offline and also displacing coal. So I will say that in the short term one could say that some of this natural gas is a plus.

On the other hand, I think the long term argument is that in 2050 how many of these natural gas plants do we really want to have around? And most importantly, what do we want them to be? Do we want them to be plants that are baseload? Do we want them to be plants that can cycle so that they back up an even higher than 33% renewable system? Where are we now and where are we going, and what does the system that we're building have to look like is fundamentally the question on the energy policy side that we've got to grapple with the Energy Commission. We really want to step up in the next few cycles to help define that and to be able to articulate it to Californians who, as Eileen said, are very much behind our climate goals, and really don't understand when we're trying to permit natural gas plants and trying to do a 33% RPS. They see it as contradictory. I don't think it's necessarily contradictory, I don't think we've done a great job, though of articulating where we're going and how fast and why.

So I'll say a few more things on RPS. One is that there is a real need to address some of the barriers right now in the state in order to make 33% even a possibility — 33% is not easy. A lot of things have to change to get us on a trajectory so we can get there. I think that's the bad news. The good news is that there is an unprecedented commitment in state government, at the agencies and the legislature and the governor's office, to make it happen. I think we have three or four years or so to put in place the fundamental framework to allow for large scale deployment of renewable energy projects and infrastructure. So it's a challenge that we've got to take on right now if 33% by 2020 is a realistic possibility.

I know that the geothermal industry sometimes feels like the large but over-looked member of the renewable energy community. Obviously it's a very important part of our renewable energy mix as we think about the system that we're trying to build in California for 2020 and 2030 and 2050. Fully exploiting our geothermal resources is very high on the list. Its environmental impacts are quite manageable compared to very large scale deployment of some other technologies as the baseload. We've talked a bit already about how much new capacity we have, that geothermal already provides 4.5%, slightly under 5 of our total electricity demand and that's a pretty big number. One expansion here is very interesting to me is not only being able to fully develop our high temperature geothermal resources but also looking at more and more creative uses of the low temperature geothermal resources or things like fruit and vegetable drying, providing hot water to residential, commercial, industrial use, biogas production, ground source heat pumps and so on. I think this is an area that's gaining some momentum but has been under recognized in terms of its potential, and I really would welcome your thoughts on how to get further there. The Energy Commission continues to do a lot of work in the geothermal area, we have the Geothermal Resources Development Account, which provides about five million dollars in grants every two or so years depending on how funding is coming into that account. We've been funding some very useful and very good projects out of that and obviously are excited about it and want it to continue. The PIER program has also been an important source of funding for the type of research that we need here. I will also say that in terms of geothermal development, in terms of everything else like solar and wind, the message that I'm giving to everybody is the same, which is that we're not satisfied with the business as usual trajectory anymore. The business as usual trajectory isn't getting us to our old 2020 goal and it's not getting us to our new 2020 goal, so we're very interested in ways of stepping that up.

Before I came here, I asked our staff to give me a short list of what they see as key issues and obstacles that we might talk to the geothermal industry about working together on. I'll just read some of the ideas they gave me. They listed ideas such as a better resource assessment especially for low temperature hidden resources, working on permitting delays at regulatory agencies and the complexity that comes from overlapping in multiple jurisdictions. Also outreach, and this is something we've done for wind and something that we'd be very open to doing for geothermal, which is outreach to local governments to assist them in understanding the technology, understanding the impacts, understanding the best way to do a meaningful and good environmental review that is not overreaching or duplicative or somehow more consuming of time and resources than it really needs to be.

Other key issues include increased look at hybrid applications of geothermal with other types of renewable resources to fully utilize the transmission infrastructure and otherwise provide reliable power to the grid. Improved transmission access, obviously that's been discussed.

There are other things I'd be happy to talk about, some of the resource conservation and renewable energy work that I've been initiating at the Energy Commission. I think and this is where technologies are different, this is going to be an issue with us with large solar thermal projects because they take up so much land. I mean the land is leveled, it's covered with mirrors, it's fenced off, and the vegetation is removed. So, at least for many kinds of projects, it says the impacts on species and land are very substantial. In that case, what we're looking at doing is the Natural Communities Conservation plan. It wouldn't be solely for solar thermal, but that's really where you get a lot of the species impacts. And we're looking at ways of creating a standardized mitigation plan and identifying, and this is obviously linked to the RETI process, but identifying preferred areas of development where we can facilitate permitting consistent with not only meeting but frankly exceeding environmental requirements.

So I think the obstacles in geothermal are maybe somewhat different. We're not limiting the NCCP to say we want to do to solar thermal, and in fact, by looking at the impacts of transmission lines as well as the impacts of projects, again, this gets us into questions like if there's a way to dovetail preferred areas for solar thermal development that's close to geothermal development that allows us to make better economic use of a transmission corridor. That's exactly the sort of thing we want to know and we want to plan for. So I will conclude by... saying that I've never toured a geothermal plant, although I've had opportunities, but I've been to the one in Salton Sea and been around it in my past work in Planning and Conservation League. I'm happy to take questions.

McCaull:

I think what's neat about Karen arriving at the Commission is that she has this background in land use and habitat issues. Maybe that expertise has not existed in this arena before.

Schochet:

My name is Dan Schochet, and I've been a geothermal power plant developer in California and Nevada, though my more recent experience is Nevada. I really have a question for both yourself and for Secretary Tutt. In going through what it takes to implement the regulations, has any thought been given to examining the regulatory paradigm under which the investor-owned utilities operate? Let me expand on that a bit. These are my customers both in California and Nevada, and I've always looked at what's motivating my customers to either continue to buy the electricity we produce or to avoid buying it.

In the case of the renewable energy, as I understand it and it's the same in most jurisdictions, the utility shareholders get no benefit - the owners of the utility - from long term power purchase agreements. In fact when they're buying mandated electricity under long term power purchase agreements, they would much rather prefer to build their own gas fired plants where they could rate base the investment in the plant and have an equity return to the shareholders. So we are mandating that the investor-owned utilities buy our product, but they don't get any benefit out of it. In fact, they do have some liabilities as a result of implied debt.

And the second aspect to this is in the areas of transmission which we have discussed. In order for the utilities to build a transmission, they would normally have to rate base it, but the PUC, which is not represented here today, would under the existing regulatory paradigm; ask them to

prove that the ratepayers would not be at any risk for these new transmissions. And if the transmission is to provide long term prospective renewable power plants, which have not yet been built, financed or sited, then clearly they don't have a clear path for the financing. So we have on the one hand the desire of the state and the agencies to foster and to enable and enhance more renewable energy, but on the other hand, we have an existing regulatory structure which seems to inhibit that. And is that being looked at under the current plan to implement the Clean Energy Acts that are being promulgated in the state of California?

Douglas:

Yes and yes. I'll say on the specific points, we're looking at everything and we really understand that there are barriers that are deeply embedded within the regulatory system and within the rules that the investor-owned utilities live under the PUC, and there are other multi-jurisdictional problems. So yes we're looking at that, and I want to invite you and everyone here literally to send my office, or maybe John, if you would do me the favor of compiling a list, it would be even better. For issues like that, it would help me a lot more if you wrote them down and put your name next to it so somebody could follow up. We're seriously looking at everything, and the Schwarzenegger administration's taking a lot of leadership in this.

On the transmission question, the opportunity we have in front of us that we didn't really have the same way before is in the past, utilities would bring transmission line proposals to the PUC on a line by line basis and each one would be looked at more or less in isolation and without the overlay of some of these policy mandates and some of these stakeholder processes like the RETI process. This is going back to where we've got this couple year window of opportunity. I've asked our siting staff to back me through the transmission siting process. Let's say, I don't know if the ISO's correct that we need six new major transmission lines in the state, they might, but they might assume that all this new electricity for the RPS is coming from in state, or they made some other assumptions that might change the calculation, whether it's four or five or six or seven or eight. I asked them to back me through the timeline and the process. It seems to me, after we did that, that there is time to get the infrastructure planned and permitted and built, but there's not time to get delayed somewhere between planning and permitting and building, and we can't fall off the wagon in this process. I think the way to make that work is to get the planning part right. If working with the various industry groups, the environmental stakeholders and others, we put together a plan that includes what we see as the top priority, new transmission lines in the state, if we do a real hard look at the environmental impacts of those lines so that nobody goes to PUC or to a local jurisdiction, if it's a muni trying to permit a line that has obvious problems when there are potential alternatives that we could plan for, then we will have a greater ability to move everything through the process and to do it in a timely fashion. So I think the sustained focus and the actual planning work is what makes it something that we stand a reasonable chance of succeeding at. Short circuiting the planning work would be a fatal mistake in my opinion. Eileen?

Wenger-Tutt:

Just to add one thing, when we were doing our Climate Action Team Report, which the basis on which the AB32 was designed, we did talk to the investor-owned utilities about an RPS, and at that point, we were keen to go for a 33% RPS. One of the major questions of the investor-owned utilities community was this equity issue - why is it that the municipals have different

requirements than the investor owned utilities when it comes to energy efficiency and the RPS. As a result in the scoping plan, you will see that the intention was to capture all load serving entities and make it equitable. That was just an overriding message that we kept getting. The representatives of those utilities were addressing the needs and the benefits for their investors as well as their customers.

Murphy:

Dennis Murphy from Potter Drilling. A couple days ago in the GEA Weekly Update, there was a very interesting op-ed piece by a gentleman named John McCaull.

Wenger-Tutt:

Is he in the room with us by any chance? [Laughter]

Murphy:

I'd just like to point out to you that it was on the AB32 draft scoping plan and how it impacts geothermal technologies. The article mentioned impacts for the geothermal industry, especially utility scale, heat pump and direct use. It pointed out that there is no specific mention of geothermal heat pump or direct use technology in the scoping plan, as opposed to, for instance, solar thermal, and pointed to the need for education and recognition of this technology and what it can bring to drastically reducing natural gas usage, and the need for a discussion on the need for LNG ports to supply natural gas users as well as many other benefits.

McCaull:

My one comment at the Scoping Plan Hearing was where's the direct use heat pump reference? Sounds like you're already a convert.

Douglas:

I would say I understand why it's important to you to see a mention of that in the scoping plan. Again, this is going back to Eileen's comment about how ARB cannot possibly implement all of this stuff. At the Energy Commission, we're really interested in seeing that happen, we're working very closely with ARB and with you. If you're thinking about a specific mission reduction measure that somebody ought to implement, talking to us about it is a first step. I'd certainly welcome you to do that.

McCaull:

I'd like to thank both Secretary Eileen Wenger-Tutt and Commissioner Karen Douglas for excellent keynote presentations today.

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Gawell:

I was standing in the back with Bill Glassley a few minutes ago listening to the question about direct use. We use these types of technical terms all the time. My question is, when we use them, do people know what we're talking about. Some of the terminology we use goes right over people's heads. There was an article not too long in Science magazine about geothermal. After hours and hours of talking to the author over the phone and giving him geothermal documents for the article, the young scientist said, "You know, I learned one thing. Geothermal is the most complex of all of the renewable resources. It's used in more ways and in different things than any of the other resources." He used that as his conclusion after writing articles on each of them. I think that's really true. Somebody's got to come up with a better word than direct use. That's our next challenge.

Talking about words. Can you tell a CREZ from a RETI? We have a whole series of acronyms, all of which seem to be geared towards dealing with the issue of transmission. Two of the major ones are the California Process Renewable Energy Transmission Initiative (RETI) and the Western Governor's process, which is the CREZ initiative instead of the Competitive Renewable Energy Zones. In the next half an hour, John McCaul and Andy Horne are going explain the difference is between all of the alphabet soup in transmission. Transmission comes up repeatedly as an issue and an obstacle, and these are the initiatives that are out there now. Andy?

Horne:

It's a real pleasure to be here, having come from the Imperial Valley; I work in the Natural Resources Development area with the County of Imperial. I've heard several people say that they'd like to come down and tour a geothermal plant. We have a special next month in August in Imperial [laughter] to come down and do that. We'd give you a really good rate.

To give the background on RETI, several people today have identified transmission as being one of the primary barriers, at least physical barriers or infrastructure barriers to the development and delivery of renewable energy in the state and certainly in the nation. And that's because of this great system of environmental laws that we've constructed to protect our environment. Last week John and I were both at a workshop, where we saw that we have been doing a very good job of educating people about the importance of protecting the environment, and we're now suffering the consequences of that.

So we have a challenge, and that is to convince people that the perhaps more limited construction in terms of environmental impacts of transmission would go a long way toward solving a larger issue of carbon emissions. Concerning the issue of climate change and global warming, how do we balance those? That's the goal. Going back a few years, when Tehachapi was really moving forward in terms of developing wind resources, there was also the Imperial Valley Study Group that looked at geothermal resources and the Salton Sea, and how those would be served by new transmission and what the resources necessary to accomplish that would be.

More recently in the early part of last year, Southern California Edison filed a request to the CPUC to study the building of a trunk line down to the Salton Sea, in furtherance of the IV Study

Group process. CPUC said that this is a bigger issue, and we need to circle the wagons, and bring everybody into the fold. So in cooperation with their sister agencies, CPUC, CEC, Cal ISO, the utility and others, they got together and formed a blue ribbon committee. And John and I are both lucky enough to have those blue ribbons as being part this.

Later on in 2007, the Renewable Energy Transmission Initiative group was officially formed. It's modeled after efforts in other states, especially Texas, which is big in wind energy. The state of Texas took a look at how they were going to get that wind energy to the load centers, and California decided to copy that process. So we have this structure with a coordinating committee of the people who make the decisions and a stakeholder steering committee who do a lot of the work. And that consists of not only the regulatory agencies but the load serving entities and transmission providers. Those regulatory groups are the permitting agencies like BLM and the counties, like CSAC and also RCRC, the Regional Council of Rural Counties. There is also the Farm Bureau, Sierra Club and NRDC. I heard Jonathan Weisgall say today that it's important to reach out to these people and build these relationships. I think that's right because we all recognize the importance of protecting the environment, and bringing all the stakeholders into the same room or the same table.

McCaull:

You've got to say a thing about stakeholders.

Horne:

I don't like that word. I call ourselves players, not stakeholders. But the environmental community plays an important role in this process. We're working through this right now. If you give them a map of the United States and say, where would you like to see transmission lines built, and X out the areas you don't want built, you're going to end up with a lot of X's, so we're trying to establish some criteria that make sense as far as what areas can and can't be.

Some of them are obviously off limits, but their list of what should be off limits is maybe a little longer than what some of the rest of us want. So we have a number of subcommittees, and John will talk about that because he sits on one of the ones that's most active. I mentioned the Environmental Work Group, and we have an Uncertainty Committee. Now, I'm not entirely certain about what the Uncertainty Committee does, but I think it does statistical modeling of what fossil fuel costs are going to be and whatever else.

So we have a number of committees, and we've developed a work plan. There are three phases of the RETI process. We're past Phase 1A, and we're into Phase 1B, so we're really making progress. The first phase would be to identify these competitive renewable energy zones that everybody talked about, and those are the areas that everybody can agree are the hotbeds, not to use a pun, of renewable energy like Imperial Valley, Tehachapi and the Mojave Desert for solar and the Geysers area. We've even broadened our horizons beyond California. For one meeting, Steve Munson showed up with this big map. He showed us where his projects were in Nevada and said that we really ought to take a look at them. So we've included looking beyond the borders of California into Nevada and even into the Pacific Northwest for some of these renewable resources. So identify the CREZs first, and then second phase would be to prioritize the CREZs in terms of how to integrate that with the transmission planning, to figure out where

the most developable CREZs are in terms of constructing the transmission, and finally the third phase would be to actually identify or come up with a transmission infrastructure plan to access those renewables.

We're making progress. The governor is putting some heat on us to get this finished. It was said earlier that we cannot as a state or as a society even meet these ambitious RPS goals and the goals of reducing carbon emissions without significant upgrade to our transmission system. Everybody realizes that, now it's a question of how do we get there? I remain hopeful that this RETI process will be more than just a report, that it would be a road map and a plan of how we get these transmission facilities built, because it is vitally important to us as a society, to the geothermal industry particularly, to get these improvements made in order for us to continue to expand this resource. And with that I'll turn it over to John.

McCaull:

Well, you can see why I wanted Andy to go first, because he presented the completely impartial view of the RETI process. We'll just call him the cheerleader. We could talk in detail about the different phases of work that have been underway. The Black and Veatch consulting firm has put huge amounts of work into this project, and I think they've actually done a great job. So there's a very significant investment on the part of the state in this effort. I don't think there's anybody who's really sitting on the sidelines, not part of this effort who should be there, so that's pretty important. And this whole thing is about relationship building, because there's a huge gamble here. I hope we will come out of this with, let's say the magic number is three to five new major renewable energy zones, where everybody agrees we should go to the next level of planning for transmission. We have to do that and I would say from my own personal perspective that the issues around Imperial County are front and center as one of the key areas.

So I want give a little flavor of this relationship building, and why it actually could be important. It centers around the environmental criteria and the environmental screens or filters that this process is trying to set up.

Just one quick note. The Western Governors' Association Western Renewable Energy Zone Effort, which kicked off in Salt Lake City in May, is a bigger version of RETI with one important distinction – the C isn't in there. It's not Competitive Renewable Energy Zones in the Western Governors' approach. It is to identify areas that have good resource potential, that are known, that should be analyzed for transmission build out, but the attempt to do a competitive analysis between them is not happening at the Western Governors.

That is a very different approach than what's happening here in California. There are two basic screens or exercises we're undertaking. One is an economic analysis of these zones, which zones would provide the most reliable power at the cheapest cost, and the second is an environmental analysis. We've spent a lot of time trying to figure out how these two should work together. The perspective of the environmental reps is that they are equally important and that they should happen simultaneously. Their fear has been that we would do an economic analysis, and then after the fact do an environmental review. I think they've succeeded in getting these to happen simultaneously. And objectively, why wait, why not just get it out there and see what we can do. So what I've been doing on behalf of geothermal with other reps from solar and wind and biomass is working in the environmental working group for several months.

The first thing that happened was the environmental community came forward with a list of areas that they wanted off limits for even considering for CREZs, Renewable Energy Zones. As Andy said it was a very long list, and our first effort from the developer side was to really start questioning the assumptions. What lands are truly off limits to renewable energy development? This isn't transmission, we're starting with the actual projects, the technologies, the development, the energy development, because there's going to be different filters you're going to use for transmission versus big solar array or geothermal plant or wind farm. And diplomatically, I think there was an overreaching going on in terms of saying what is truly off limits. There was what we'd like to see off limits, and then there is discretion on the part of federal land management agencies, other agencies, other land managers – this is mostly public lands we're talking about – to mitigate a project, to allow for siting, to adjust a project so it that it could go forward. I think that we've struck a tentative balance on that. There are certainly lands because of federal law or other restrictions that are truly off limits, and you could challenge those but we're hoping that there's enough out there to meet the 33% goal without that. The whole point of this exercise is to identify the net margin. What is the margin that we need to meet in terms of new production and new transmission?

There are some draft maps that are out now, and this mapping exercise is an exercise. We're going to look at these maps, we're going to see what they preclude or allow, and if we don't get to the 33% then we're going to look at those maps again, and that's the perspective of industry on this. Now, there's a scoring exercise, and from both the economic screen and the environmental screen, these zones will be scored on a scale of 1 to 5, 5 being good or bad, I can't remember.

Horne:

One is good and the other is bad.

McCaull:

You either want a really high score or a really low score, so there will be an economic score and an environmental score, and the environmental score is going to be based on a set of criteria, and hopefully, you would actually have for the policy makers a pretty simple mathematics of where we should be moving forward, but underneath that is a high level transparent detailed analysis.

I just wanted to flag a couple things which I think are really interesting for folks in the business. Our criteria in order to derive this score are things like what is the development footprint, is the land that's being proposed for development disturbed in any way? Certainly there's BLM land out there that historically has been mined or grazed or different things. Can we look at public land or private land, are there brown fields, and are there areas that are degraded that we could actually make a priority? What are the sensitive habitat issues around particular sites, we'll have to spend a lot of time on that, and what are the culture resource issues, that's a big deal as well. So we're trying to basically take all these criteria, and come up with a way to rate them, compile it all together and come up with a score. We're moving to the point where by mid-August, we will have maps out for everybody to view, for both the RETI group and the public. This will be the first attempt to put these Competitive Renewable Energy Zones on the map and see what kind of impact we think they're going to have and what their economics are. The push coming

from the governor and the administration to have this done by the end of the year coincides with the push to get the AB32 program done by the end of the year as well. It's a coincidence, but it means that there's a lot we could accomplish.

What we do here in California through RETI will guide, from the geothermal industry's perspective and the other developers, what we do with the Western Governors. They're timed so that we can do a lot of the key work, and hopefully, build off of it at the more regional level.

Gawell:

Thank you, John.

Schochet:

Just to point out to the audience that we've gone through a similar exercise in Nevada. We've actually completed Phase 1 in Nevada and there's a Phase 1 report and a set of excellent resource maps which were prepared by my colleague. It's on Governor Gibbons' website in Nevada under the Renewable Energy Transmission Accesses Advisory Committee, so that you get a sense of what these maps would look like. That was one of the work products and I hope that RETI can come up with work products that are generally of similar quality.

Munson:

If anyone in the room is interested in looking at transmission alternatives from Nevada to California, you could look at G3plan.com. It shows a renewable energy zone in Northern Nevada that includes our properties and a lot of other people's properties. It also has some transmission lines that have actually been filed on and are now in a federal permitting process to move potentially a thousand megawatts or more of our power and other companies' power to California, so those transmission line routes have been filed. Thank you.

McCaull:

I just thought I'd mention that Jim Lovekin, who's here today, is under contract working on this whole effort. He's been doing a great job identifying the geothermal resource base for RETI. So if you have questions on the kind of how things are shaping up in terms of projected geothermal resources, please ask Jim. You want to raise your hand there Jim? Okay.

Horne:

That was one of the things we kind of glossed over. We have tried to incorporate onto the RETI steering committee, representatives from each of the renewable technology areas. Their job is to coordinate with their individual generator colleagues, and feed that information into the process so as accurate as possible model could be developed in terms of figuring out what the resources are and what the potentials are.

Question:

Andy and John, question about the RETI mapping. I know the programmatic EIS had a map of different areas that are not available to geothermal leasing in California and it was pretty dramatic. It was like half the state is off the map. I understood they were going to produce maps for the RETI process for California. Are those going to be publicly available?

McCaull:

Yes, there's some you could already access off the RETI website. The easiest way to get to RETI is just Google RETI, it comes up number one, but you can get there through the Energy Commission's website. There are some graph maps, which are basically an array of different screens, and you can look at those and be shocked, because there's certainly a lot of X's on there. That is existing law about what's out in the field, so I think that it is very important point to get the BLM programmatic information in the RETI. We're getting there but the BLM solar guys are there but not the geothermal guys, so it made me a little nervous.

Horne:

I'll just add a couple things. We do have BLM people who purport to speak for the entire organization, but we also have the military representatives there. I think the guy's from the Navy to speak for DOD. They have obviously provided us with a number of X's also, but there are two real mapping processes going on. One is to locate the CREZs, and the second one is to locate and/or eliminate the areas to be considered for corridors for transmission. Both of the processes are equally important. I think the latter than the former, because most of us in this room could probably take a map of the state of California or western United States and tell you where the resources are. It's more important to actually identify and specifically try to locate where those transmission corridors are going to be possible. So that really is the key to the kingdom.

Carter:

On this question of where the corridors should go and identifying the resources, identifying the resources is easy for biomass, wind and solar. But identifying resources for geothermal is not easy and there are a lot of unknowns. So how do you weigh an economic analysis when you don't know yet what an area might produce in geothermal once it's been fully explored?

McCaull:

My short answer is we don't have enough time to address that successfully today. I'd be happy to talk with you or anyone who's interested. There's been a lot of work on the methodologies and assumptions and basically there's been certain assumptions around capacity factors and around land development costs. You name it, there's basically built in assumptions, all those have to be transparent. I don't think it's true to say that for solar, it is easy to pick where those resource areas are. I think they have a much bigger issue around siting. You could say it's a good solar area, but it depends on the screens and issues around them, so I'm not sure anybody is particularly advantaged one way or another.

Horne:

I hope I don't offend anybody by saying that the competitive zones for geothermal, based on current technology are pretty well known. Then as we move forward toward the 33%, we have different issues. Some of the other presentations today have been about emerging technologies on more low temperature resources and so forth, and getting a better handle on where some of those sources might be that we haven't identified yet, that will come into play. But for right now when we talk about competitive, when we know where the resources are, it's a lot cheaper to develop those resources than it is to go out and try to identify new resources for the short term. And I think that's part of the emphasis at this point.

Duggan:

Kevin Duggan with Calpine. John, you mentioned that in the environmental score there were a number of factors. I've actually got two questions. One, how is each of those environmental factors weighted, are they equal in weight? And the second question is about the cultural factor included in the score and I was hoping you might be able to explain a little more about how that cultural factor is calculated.

McCaull:

The environmental groups basically put forth nine different factors. We've been trying to collapse that list for several different related ones, but yes, they would all be weighted equally to get to this one number. We're not going to have nine environmental 1's and 5's; we're going to have one number. They would be weighted equally. This is still a very live dialog, and Kevin's been one of the geothermal people who's been very helpful in providing feedback. Anyone who wants to look this list, I'd be happy to talk to you about it.

Cultural, we had a special presentation from BLM on how cultural sites are looked at on federal lands, and it's basically the number of cultural sites per megawatt hour production. That's the formula we've got, it's pretty straightforward.

Horne:

These are for Native American cultural sites.

McCaull:

Yes, it's archaeological sites. So it's existing policies of BLM and Forest Service about how they identify them, and we're just doing a straight count. Are they identified on a map, and how many are in that CREZ? And then for counties and the state there's a whole process as well set up for state for cultural resource identification. We're not making up anything new if that's helpful.

Session 5 - Direct Use and Heat Pumps: Their Role in the California Energy Landscape

Gawell:

Thank you very much. Next we have presentations by Rick Phelps and Lisa Meline on direct use and heat pumps and their roles.

Before they speak, I want to take a minute to talk about a third area, Small Power Production. A very controversial subject in some ways, but since Chena Hot Springs put in their small turbine in a remote setting in Alaska, there's been a strong renewed interest in distributed generation using geothermal energy; particularly lower temperature organic rank and cycle system. Both at the SMU conference and the GEA workshop, there were quite a number of people interested, both financially as well as technologically, companies talking about other small turbine products that could be used.

Having worked for a number of years in the wind industry I know that the utility scale wind industry's the big market, but there also still is a niche for small wind projects. I think one of the unanswered questions we have in California is what does a small distributed generation geothermal market look like, how big is it? The reason I say that is because you've heard everything about the holdup - can you get the permit, can you get the regulation, what can we do? A power plant's one thing. But if you're able to select a winery or something else that's going to use a small power unit, I would think your ability to permit is going to be much easier. There are areas in the state where the geologic map says there's resources, but you simply wouldn't build a power plant. However, they may be accessible to distributed generation type systems. So from a national perspective, we are getting a lot of interest in it. There's only one or two projects counting co-production projects, but I think it's an area that we need to take a good look at. It may only be 225 kilowatts or 200 or whatever the small unit is, but how many of them could you do in the state? Is it 1? Is it 10? Is it 100? And how many direct use sites are in the state, and I mean direct use where we've already got wells, we've already got temperature coming up that you could access a small power unit. We don't know if this is a small issue or a big issue, and if it is a big issue if it could be an area exploited in the future.

We actually had scheduled someone from UCC Power to come talk about their Chena project but about two weeks ago, they ended up having a conflict so could not be here. Not to say they're the only one, there are other companies producing small power equipment like Ormat. In California, they're giving a very high premium to under one megawatt renewable power systems, so the economics of small power and distributed generation are completely different from large systems. You can justify a lot more because of the price of nuke and gas.

And now Rick Phelps is going to speak on the direct use Mammoth project, which he's been championing for awhile.

Phelps:

I'm with the High Sierra Energy Foundation, which is a non-profit that was set up about three and a half years ago by citizens who didn't feel that appropriate attention to energy efficiency and renewable resources was going to happen without a third party involvement. And since that time many people in this room including Karl and Bill, Elaine, and Pablo, have been helpful.

Sean Arnold who works with Iceland America has also been helpful and we've made some real progress.

I have to tell you about my first public involvement in Mammoth. We had a small budget, and I had to think about how to get public awareness and how to get support. I had an interview with the local television station. You have to understand Mammoth has a permanent population of about 7,500, which grows to 30,000 to 50,000 on weekends either winter for skiing or summer for fishing. And I gave this interview on what I thought was a nice educational overview of the Long Valley caldera and heat sources, and I talked about volcanic eruptions. Afterwards, I was driving back up the hill to Mammoth, and I get a call from the owner/managing editor of the station. She says, "Rick, I just listened to your interview and we don't talk about volcanoes up here." I asked her if she could edit it out, and she said that it's already done. I said, "Okay, I won't talk about volcanoes anymore, but I appreciate your help."

Our goal in the project is to deliver geothermal heat to residents and businesses at economic prices, and to partner with an experienced third party to mitigate the risk to the town of Mammoth Lakes. The town would be unwilling to take any kind of development risk on their own. We want to be sure that the residents, businesses understand the benefits of geothermal heat. We don't use the term "direct use", we'll talk about geothermal heat or a geothermal heating district. And there's also another side is promoting Mammoth Mountain ski area as an *Operating* "Green" resort. I had to put the operating in it italics and green in quotes, because so many resorts in states east of here will talk about their environmental awareness, but rarely are they doing anything at a local level, they're buying credits somewhere. And the CEO of the Mammoth Mountain ski area, Rusty Gregory, is very much a supporter. He wants to make it happen at our local level, and we have the resource to do that.

The benefit is we can reduce costs. Residents and businesses now spend about 11 to 13 million annually for heating energy, and almost 100% of that comes from fossil sources. We estimate that improving the environment is somewhere 30,000+. But the interesting thing was how we had to come up with the cost of the energy from electricity. Propane is a totally unregulated resource. The town worked with us, since they knew the amount of sales tax they had collected from propane, and then we had to make some assumptions on propane price. We had to go back to customers, and then we had to impute back to the total amount of energy used by the town. We do want to showcase Mammoth as a town that is on the forefront of working with renewable energy. We have a separate effort for energy efficiency, a partnership with Southern California Edison that we're expanding for the next rate case cycle to include all of Mono, Inyo, city of Bishop, and city of Mammoth Lakes, which is thousands and thousands of square miles and probably about 30,000 permanent residents.

We started with a GRDA grant where we said we need to structure what the businesses of the heating district of Mammoth Lakes were. A lot of money had been spent proving that there was hot water under there and as Gordon Bloomquist said to me, "Just put some holes in the ground and get something done. You don't have to prove there's hot water."

But we needed the structure to do it. First we went through a marketing phase, looked at operators, and looked at the legal structures. We did market research. It was very unusual for a renewable project, but the question I wanted to understand was how sensitive people were to the actual cost. What we found was that 80% of the people were very acceptable, but if your price

was not competitive or less than propane, the number went way below 20%. And that was an important number, because as someone said in one of our focus groups, which was the qualitative, not the quantitative part of the research, "Even environmentalists have to save money." And so this has been sort of our mantra as questions come up, is this is going to be an economic project that is going to make sense, otherwise we couldn't sell it to you and we couldn't involve others. Another thing that we learned from our marketing research is businesses in town don't want the town to do this by themselves. They want somebody else involved, and we've had an active working partnership with Iceland America Energy for 2 ½ years, bringing in expertise from a country that uses geothermal heating districts. That's been very helpful in selling the project.

We had to figure out what the structure was going to be, who's going to run it. We looked at all the different operators and did interviews and evaluations from the town to the propane providers to the water district to outside third party private companies. We ended up with a private entity and a public entity at the top of the list. The private was Iceland America Energy and the water district in town was the other side.

We also looked at legal structures, which could include the joint powers agreement, a town utility department, or a town utility department with outside contracting, which had a lot of advantages. You don't have to just use the town; you can contract everything out and still deliver the benefits.

Initially, we thought we would do a joint powers agreement, but it turned out that the water district was very difficult to work with in terms of their concern for potable water, and protecting their reservoirs, etc. So we decided to contract with the water district for customer service functions. I think that they will eventually be in it when they see what we are doing, but it was one of those negotiations that was stalled, so we agreed in a friendly way that we wanted to move on, get it further down the line before their involvement could be better defined.

Right now we're working with the town, finishing up our CEC grant. We're looking at the possibility with Mammoth Pacific, where there's 40+ megawatts, and we're in discussions now of buying some of that heat to put into the project. And we're also looking at identifying potential drilling sites on properties where the owners have the subsurface rights as well. Initially we had hoped to use a provision in the Energy Policy Act of last year that allows small noncompetitive leases for geothermal direct use, but when somebody wrote the legislation, they neglected to allow for cost recovery, so you couldn't sell it, which made it totally untenable. We've had very good conversations with BLM, who suggested we get congressional relief, which we're working with as well. But in the meantime, Mammoth Mountain ski area and others that have rights where they have geothermal, we're looking at those as potential drilling sites.

This slide shows the town of Mammoth Lakes. The power plant, the Ormat Mammoth Pacific power plant is on the far right. The S's are basically where there's potential sources within town. The L's are where the big loads are, and the shopping centers, also the big parking lots where we envision building melting pits. A big shopping center up there will spend 100,000 to 200,000 dollars a year hauling snow away to dump out of town. If we can work out the water disposal issues, that'll be a great source of revenue for the heating district. Now, the dotted line with the question mark would be from the Mammoth Pacific facility. One of the real advantages, if we

can get some heat from there, it would allow us to deal fairly short term with some of the major schools, library, college, government loads, which are those L's at the end of the dotted red arrow. That would establish the viability of the system of the geothermal heating district as well as gives us a chance to get the bugs out of the administration, working with Iceland America and others in that area. Plus we would still go through an environmental process, but it'd be pretty much an environmental process on town right of ways, so we could move fairly quickly. That finishes up my presentation. Next Lisa Meline will talk about heat pumps. Lisa?

Meline:

I want to talk to you today about ground source energy. I want to talk to you about heat pumps. I was given the task of addressing this in the time allotted, so I'm going to just blaze through this, so at the end, you'll have time for questions.

First of all just to let you know, I am with Meline Engineering here in Sacramento, we're a mechanical engineering firm, and we do all types of HVAC design work as well as plumbing, but our specialty is geothermal heat pump design. So I was tasked with how do geothermal heat pumps help meet the RPS goals, and how can we partner more effectively with other renewables?

I understand I missed a bit of a debate this morning on all the different names. They also go by Geoexchange, they go by ground source heat pumps, and ground coupled heat pumps. They're all the same thing, and I'll give you an idea of what these actually look like and how they work.

First, let's take a look at how a geothermal heat pump works. Basically, we're trying taking the earth's energy, circulating that into a heat pump in a building or a home, and then taking that heat into or rejecting that heat from the home. On the left hand side of my diagram, you have a water loop, which is buried pipe outside the home, circulating fluid between the heat pump and the earth. The diagram is showing a heat pump in heating mode, which is essentially a refrigeration cycle, so it's similar to an air conditioner. The only difference is that it is reversible.

Here's what a heat pump looks like. They come in all sizes and shapes, all different brands. And here's an example of the loop. This is a pretty common diagram that you'll see in the industry. There can be different types of loops depending on where you are, and what kind of resources you have at your particular site. There's even opportunities to couple with surface water, a lake or a pond.

So, how do we get to 20% by 2010? Well, being a heat pump person, I think the way we get to 20% is to redefine renewables. Typically renewables are all the things that you've been talking today. I have to admit I feel a little bit like a fish out of water, but I think this is an important part of what we're trying to achieve here in California.

We need to continue to support the intent of the different rating programs that are out there, and I'm going to focus primarily on LEED certification, which is one of the means by which the state of California is trying to meet their overall energy reduction in the state. When I say intent, LEED is a great program, there's other programs out there like Energy Star and Build it Green, which are primarily focused on residential projects. What they're all trying to do are good things. I think you can do these things by doing good design and putting the money in the right

places on your building or remodeling project. Basically buying as much energy efficiency as you can afford. The LEED Program has promoted more energy reduction, but I don't necessarily think you need to get a certification to say that you've done it.

The other thing to look at is innovative applications of geothermal heat pumps. We're used to seeing them in houses and in office buildings, but you can apply them to agricultural situations, we've done them at wineries. The reason I'm showing this picture here of Calpine is that we recently talked to their facilities people about using the waste water that they get from a nearby water treatment plant, and tap into that water which is a nice 75 degrees, which is a perfect temperature for geothermal heat pumps. They would use that water, not only to help the plant make electricity, but use that water to heat and cool all the different areas of their facility. So there is the opportunity for using it for two purposes, which I think is an excellent idea. That's what I mean by innovative applications of the heat pumps.

So how do we call heat pumps renewable? This is always a stumbling block, but this is the way I see it. In this diagram, you're going to see an arrow here at the bottom where you're getting three kilowatts of energy from the earth, while the arrow at the top shows you're buying one kilowatt of energy from your utility. Together you get four kilowatts of energy delivered to the home or to the building. And so that's essentially what we call a COP (Coefficient of Performance) of four. We're using the earth as a thermal energy storage device. We're putting energy that we're pulling out of our building during the summertime into the earth, so that in the wintertime we can pull that energy out again to heat it. So this is how I see geothermal heat pumps as being a renewable.

There are some innovative ways to do the loop coupling with the heat pumps. This slide shows that you can put your pipe out under the lake, under the pond, so this could be irrigation water for a golf course, and you could also use that same water to heat and cool your buildings, or in this case a recreation area, where that same water is also used to heat and cool the homes in this particular development.

Another idea that I've been really pushing, and I'm starting to see it take off is a sustainable utility. Essentially what you're doing, in addition to providing electricity and gas and sewer and cable to your housing development or building complex, is provide a condenser water source along with the utilities for tapping into each of your buildings. The idea here is that you reduce the first cost on the system because you can take advantage of the diversity between the buildings in the development. Here's a picture of the first all-geothermal, all-electric utility going up in British Columbia, Canada called Sun Rivers. So people are doing it, and it is starting to gain some momentum.

And finally I mentioned LEED. I am an accredited professional for new LEEDs construction, and these are the different ways that you can apply the geothermal heat pump technology to help you reach the Silver Goals, which is what the state has set for their buildings. There's all different ways you can do that by installing a geothermal heat pump system. You can use waste water; you can get rid of equipment on rooftops that helps with the heat island effect. Obviously, if you're using cooling towers in a central plant, you reduce your water consumption, which I believe is going to be the next big issue for the state of California. Well it already is.

Although we don't call heat pumps typically renewable, a renewable technology the way they're currently defined, one thing the technical society I belong to is talking about is achieving 50% and beyond, getting to net zero use in buildings. And I'll tell you what, 90% of those projects that they're featuring have geothermal heat pumps. I know that's a lot of information in a short amount of time, but I wanted to make sure that I gave you another perspective of a technology that needs to be thought about as you all are doing your planning for getting to 20%. Thank you.

Gawell:

Thank you, Lisa. Questions?

Wardlow:

I'm Charlene Wardlow with Ormat and actually had the privilege of working with Lisa ten years ago in my church in Petaluma, so it's good to see you again. But my question is how you would use this technology on water reduction for a cooling tower?

Meline:

Well, it's a closed loop system, so once you fill the system, purge it and bring it up to pressure you should really never have to put any more water in that system, so that water is continually reused. That is different from a cooling tower. If you have the cooling towers that you normally see around here, you have to replenish that water because you're using the process of evaporation to cool that water. So it's a different process and that's how we would save water.

Question:

Hi, Lisa. Have you talked to CEC or PG&E about getting a special sort of dispensation for the tiered rates so that if you put a heat pump in your house and you bump up to a next tier you're not penalized? Since the heat pump uses electricity that can be a concern.

Meline:

I have not personally, but there are people in the industry that are working together to try to get geothermal heat pumps seen in a better light and analyzed more favorably to the way they're actually operating than they are currently treated in the efficiency standards, well, not so much the standards but in the software that we use to show compliance during getting construction permits. But we are making great strides.

Question:

We talked about this I guess earlier. I just wanted to know anecdotally about the growth at the industry level from your perspective in the past few years, just your own experience where you think it's headed.

Meline:

Well, you know we've always focused on the energy efficiency. We were green before it was cool to be green, but in our office I'll tell you what. We have just seen probably 80 to 90% of the volume of work in our office is geothermal, and that's the reason I couldn't have lunch with you this afternoon because I had to get some work out, so it is just booming. It's amazing.

Kent:

Hi, I'm Kathy Kent with GEA, and we get a lot of questions about heat pumps. I have been sending people to the IGSHPA website, as well as the Geoexchange website, and I'm wondering if you have a better contact for us to give to people for that.

Meline:

No, that's pretty much it, although we did have a group, a collaborative group that was working on that, and we made some progress but I'm not really sure where we are at this point in time.

Gawell:

I think we may be one of your major sources of hits on those websites. We get asked about direct use and heat pumps, particularly a lot, so it's actually been useful to work with ClimateMaster and some others to learn a bit more, so we can at least talk about heat pumps. I can say that from our experience that the interest is substantial.

BREAK

Session 6 - Status and Outlook: Bureau of Land Management Leasing and PEIS

Gawell:

The BLM process has been going on for quite awhile. The draft document is out, and there's a hearing on it later tonight, so I'll turn this over to Jack Peterson, who will introduce you to what they're doing very briefly. And then we'll hear from Kermit Witherbee, who is the BLM's Geothermal Program Director. Kermit will be here to tell us exactly when they will lease whichever parcel you want to ask them about. Jack?

Peterson:

We have a BLM Hearing over at the CEC tonight and I've got to get over there to set up. I'm going to leave you in Kermit Witherbee's hands and he will take Q&A interminably. So what I want to say mostly is a warm, heartfelt thank you, because at a Collaborative meeting, approximately a year ago, we announced that we were going to do a programmatic EIS, and we'd be back in a year with a draft. And there were gasps, and there were scowls, and there was a lot of apprehension, and there was skepticism in the room. And we're back. And we have a draft. The draft has been on the street since the 13th of June and the comment period is until the 19th of September. Tonight we are having a public hearing at the California Energy Commission from 5:30 to 7:30 p.m. here in Sacramento and you're all invited. Achieving this draft 1,200 page, three volume report in one year, I have to help you understand how valuable your

Collaborative is, and how valuable a collaborative team effort is. There are a lot of people in this room and organizations in California that have contributed immensely to this effort. I'm not going to name persons, but I'm going to name organizations and if I miss any, I apologize.

First, the California Geothermal Energy Collaborative, itself. It's where we came, it's where we shared, it's where we got some initial feedback, and we moved forward. Next is the California Energy Commission and its senior staff. They were immense help. The Geothermal Resources Council, their staff and library in Davis are a resource that if any of you have not taken advantage of you really should. It's one of the great resources and archives of geothermal energy in this nation. The Geothermal Energy Association has helped us all along the way, when there was access to information or a missing publication or an individual that we needed to contact. Our colleagues at the U.S. Geological Survey in Menlo Park, tremendous help. The U.S. Department of Energy everywhere, Washington D.C., Golden Colorado, over at Idaho Falls, and graduates of US DOE who had retired, and we still contacted them in emeritus manner. And then our colleagues in the Forest Service, the Bureau of Land Management, the Environmental Protection Agency, U.S. Bureau of Reclamation. Major contributions to our effort. To NGOs, nongovernmental organizations and conservation groups that we worked with. The California Division of Oil, Gas and Geothermal Resources. The various state geological surveys were enormously helpful. Then every effort is a team effort, and those I just mentioned to you are members of the team. We also have some core members of the team that are in the back of the room. One is David Batts, another is John King. They are the two principals of a small Environmental Management, Planning and Solutions, Inc. firm from Boulder and San Francisco. Their professional staff are some of the most talented, hardworking people I've ever commissioned in my life, and that's speaking of 40 years of experience. They're a positive, very professional, persistent and can-do organization.

Finally, collaboration. I can tell you whether you're a generation or a generation and a half younger than I am or you're a generation older than I am, the value of going into a project like this with a collaborative team effort across agencies, across academic organizations, research organizations, conservation groups, across companies, results in the ability to meet schedules that are otherwise untenable. This is a great lesson to me in the value that I've known all my life but really it's been such a pleasure to execute something in one year that normally takes three, and I can look around this room, and you know in your hearts when I scan my eyes across yours, I thank you. Tonight 5:30 to 7:30, California Energy Commission. On your agendas on the bottom is the address of the California Energy Commission, and in your folders the staff have put a map of how to get to the California Energy Commission. And we thank you.

Gawell:

Thanks, Jack. Thanks for all of your work on the Western Geothermal PEIS.

I want to introduce Kermit Witherbee who is the BLM Geothermal Program Director. Kermit is a person who tries to get stuff done within a very complicated agency with a very complicated mission, which means keep everybody who uses the public lands happy. When you're dealing with the public lands, particularly when you're dealing with things like parks, wilderness, mining, geothermal use, you can't always do it. It's often a zero sum gain. And so I have a lot of appreciation for the work Kermit and his whole staff does because these are tough issues, people love the public lands, they really love our parks, they love what we do, but it's also

critical for geothermal that we be able to maintain reasonable access, to be able to use these to help protect the public lands from what is now its greatest threat, which is climate change. Kermit, thank you.

Witherbee:

Thanks, Karl. It's nice to be on the West Coast again. We have a travel budget and I originally planned on attending all 13 programmatic public meetings. Then I was told that I could only attend half of them. I said that I really need to go to Boise and Salt Lake again, but I'd rather go to Alaska and end up here in Sacramento and then Reno.

But for those of you that aren't familiar with the Energy Policy Act, I'll give you a little brief summary of what it did. It completely revised the Geothermal Steam Act and how the Bureau of Land Management leases for geothermal. Prior to our publishing rules and sort of having a moratorium on leasing, leases during that period would noncompetitively come in the door, you pay your filing fee, you pay your first year's rental and sit and hope and wait and hope the BLM will issue your lease at some time in the future. And some of them had been sitting around since the mid '70s waiting for one process or another. At the time, the Energy Policy Act language was being worked on, there was testimony from Interior or Bureau that said there were 194 outstanding lease applications that both on the Forest Service and BLM. I haven't been able to document that even going through our files, but it's up in there. And presently the programmatic EIS is actually evaluating 19. There's probably a total of about 40 or so sitting out there that are being addressed through the NEPA process. The Truck Haven Environmental Impact Statement that was just completed and we expect the record of decision to come out this Friday in the Federal Register. We hope to get those leases issued to those lease applicants by the first part of September, and then would have two blocks of leases within the Truck Haven area available for competitive lease sale. Maybe sometime this fall, Sean Haggerty and Leroy told me that it may be in conjunction with their oil and gas lease sale. And that opens up additional areas around there. The Ridgecrest area around Coso, there's lease applications there, and there will be an environmental document done separately for the rest of those leases. So all in all, we expect they have most all of the outstanding lease applications taken care of. Of course they're no longer accepting noncompetitive lease applications for leasing unless it's direct heat. But the leasing program that we have today is a two-tier system. We accept nominations for competitive leasing from industries. The maximum size is 5,120 acres for a nomination, and it must be accompanied by a nonrefundable \$100 per nomination fee and plus ten cents per acre. It can be larger than the maximum size providing that there are lots or irregular surveys in there that would take the acreage up a few acres here and there.

A company or entity can nominate more than one set of nominations, and they may also request that more than two be nominated as a block to be sold at one bid per acre. Then all the leases within that block would be issued to the high bidder. Any leases not selling in a sale for like the big parcel lots sale would then be available, in what we call a two year window, which is a term that came from the oil and gas leasing process. This process essentially parallels the oil and gas leasing process, and they're available noncompetitively for a period of two years after the sale to the first applicant that comes in and puts down their application fee. The day after the sale if there's multiple filings per parcel, then we hold a mini lottery, and it's offered to the person whose name is drawn out of a hat. At the end of two years, the land would have to be again re-

nominated. After 30 days, the parcels can be split up into smaller acreages or combined from parcel to parcel and whatever's left over stays in the hopper at least for a period of two years.

The other provision of leasing noncompetitively is for direct use. An applicant files for a noncompetitive lease for purposes of using the resource directly for agriculture, aquaculture, space heating, whatever. And those nominations are posted for 90 days to see if there's competitive interest. If there's not competitive interest, then the lease would be issued if the lands are available. And these are not for sale. You can't net meter even if you're generating electricity for your own purposes.

Another type of noncompetitive lease is the mining permits. If the mining operator out there, the claimant, has active claims and an active approved plan of operations, and this is mining, this is not going out there and exploring, we may issue a lease to that mining claimant. The purpose was mainly to do away with interference in mining operations. And those leases if they're issued are not restricted to just direct use. They can generate electricity and sell or net meter or whatever.

And then the third type are direct use leases, noncompetitive leases to communities, municipalities, Indian tribes for public purposes like for space heating, snow melting, generating electricity within their own community without sale. Net metering is not allowed and the only financial money up front is the application fee. An annual rental is required and the negotiation of minerals and service on a nominal fee in lieu of a royalty or a direct use fee. Matter of fact, Mammoth Lakes, right now, is looking at acquiring a direct use lease I understand for space heating and snow melting.

Another activity we're currently doing and there's a cut-off date as required by the regulations in the Geothermal Steam Act as amended is the producing lessees and non-producing lessees have the opportunity to convert their lease terms in part and they must apply by December 1st of this year. And they can convert the entire lease term, they can convert just royalty or they can convert just the direct use fees or royalty and direct use fees, so they have three chances. Convert the lease, convert royalties, and convert to direct use, or convert royalty and direct use fees. For producing leases, the royalty rate will be determined less on revenue, and based more on royalties for the sale. Which means, essentially, is that if you're paying \$100,000 a month in royalty fee, you should be paying \$100,000 in royalty based on gross proceeds at the sales point, and of course doesn't count for parasitic use within the power plant itself either.

As a matter of fact, we're having a workshop tomorrow in Reno at 1 p.m. tomorrow afternoon, and we have a contractor, Jeff Epping, he formed his own company called Energest, and he's been working up the model for modeling and determining what the gross proceeds revenue neutral royalty rate would be for those producing leases. He's developed a generic model which will be available to those producers who want it to run it to see how it compares to what they're now paying on netback. He previously was working for ARI, which is Advanced Resources International, and they had the contract for doing the royalty analysis for revenue neutrality for regulations. We were restricted at that time to coming up with a royalty between 1 and 2 ½ % for the first 10 years of production and between 2 and 5% for the out years after that 10 years, and we had quite a few iterations of modeling and the typical committee meetings. We finally came up with royalty rates that were established within the regulations of 1.75% for the first 10 years and 3 ½ % for the out years. Those non-producing leases can convert to the 1.75% for the first

10 years and 3 ½ %. They can convert the entire leasehold over and pick it up. Their dates on the leases don't change, but they'd be issued an entire new lease on our new lease form. So leases that were issued prior to the effective date of the regulations, which is June 1st of last year, have until December 1st of this year to elect to convert their leases over or their royalties over.

But those lease applications that are still outstanding that will be issued subsequent to when the regs became effective last spring or last summer must make that election prior to the lease being issued to them. They'll be notified by the state office that's going to issue the lease form when it's ready to be issued, and apprise them of their opportunity to convert then and the procedures for doing it. For those producing leases that don't convert, they have the opportunity to get a 50% royalty reduction on new production for a continuous period of 48 months after it's approved. There are procedures within the regulations and qualifications that will be evaluated by BLM when applications are received to get that royalty reduction based on qualified expansion and new production.

That's pretty much the whole thing. There's one other aspect that the Energy Policy Act gave the Secretary of the Interior, the Bureau of Land Management, a stronger authority in doing those unitizations. Under the lease term BLM and the regulations, BLM could require unitization for lessees and they can be added to a stipulation for new leases that they will commit and join a unit. But the language now gives the Secretary of the Interior the authority to initiate unitization which means that it gives the authority to cancel leases that don't comply because they're not complying with the lease terms of the law. Something we haven't dealt with, hopefully we won't have to deal with situations like that in the future.

We have a lease sale scheduled in Nevada at the Nevada state office in Reno for August 5th; I believe there's 35 parcels being offered, over 105,000 acres. And these are all from nominations I understand and I think there's three block nominations within that 35 parcels of I think two or three lease parcels per block. Utah announced they're having a lease sale on November 18th in Salt Lake City, and they've received quite a few nominations in Utah and will also have several blocks available. California, as I mentioned earlier, hasn't set a date yet but we expect one in the early fall. Oregon has received nominations and they're out to the service management agencies and have the next step of NEPA done and stipulations applied and whether they have to do EAs or determinations of new adequacy.

Oh, another thing we're doing, and if any of you have been on the BLM website, and it's LR2000, which is our legacy leasing land database, covers everything from oil and gas leases to right of ways, to geothermal leases. You can find out what leases are available in certain areas by district, by state, by county, or by operator, by lessee. And you can also query and find out where the producing leases are and leases that have expired previously. But there's also a link between this land records database, and the GIS called NILES. It's a GIS database that would display leasing information, land information on the screen and web environment and you can print the files out, you can zoom in and zoom out and query around and you can click on a polygon on there and it'll take you to the serial register page and get all of the transactional history on any particular leases that are out there, open or closed, producing or not. We're having that field communicator for geothermal enhanced, so you'll have the capability of displaying producing leases, all leases, and several other layers, so it's far more useful in terms of any land title work that you might be doing a due diligence if you're going to nominate new lands or looking for properties to acquire.

Gawell:

Kermit will be around to answer questions, so we can wrap up and get done on time, because I know some people actually want to participate in the BLM hearing too. But it's great to hear we have some new lease sales planned. These are really the first sales based on new nominations. I guess the sales held previously were holdovers from the old leasing system.

It's been a great day; I think we've covered a lot of ground and it's brought me up to speed. I find these meetings particularly useful to just figure out where things are today. I was particularly impressed by the discussions between the PIER Program, DOE, and the Collaborative. I think there's a lot of potential for going forward, and I hope you find that potential to make things work. The Geothermal Collaborative for me has a great value. For one thing, it demonstrates the broad support for geothermal in the state.

I don't really have any epiphanies today, but we do know that we don't know what the resource base is. When somebody said it was somewhere between 2,000 and 20,000. I said, you've got like a 90% confidence you've got 2,000 or 3,000 megawatts, and you've got maybe a 1% confidence that you might have tens of thousands. We just don't know. And I think that a lot of the things we sort of presumed as key questions are still there, and I think we did a pretty good job of identifying them.

Glassley:

I think what the future holds for the Collaborative is potentially very rewarding, but I think given the diversity of discussion that took place today and the number of topics, we have a challenge ahead. The challenge facing us is to find a way to coordinate, as effectively as possible, all the different elements of geothermal, and the issues that have been raised. What kind of vocabulary do we use, and how do we get the public aware of what we're about. I think that one of the things that is clear as a result of what happened today is that the Collaborative itself needs to come up with a better way of identifying what its specific goals and mandates should be. I hope that the CGEC Development Plan that's in your packets will be a way to encourage you to come up with ideas. Provide us with your input about where you think the Collaborative should be going and how best it should structure its message. If you could do that, we would greatly appreciate it. Email me as I said before with any response or comments you might have because we would like to fold them into the CGEC Development Plan.

I want to thank everybody who participated in the 2008 Summit, both the speakers and the audience. I think the discussions that took place were extremely useful. There are two things that you should know. All the PowerPoints that were presented today will be post on the CGEC web site, so you should be able to access those via the web. There will also be a summary of the meeting at a later date. Thank you for your participation and your comments and for keeping this a lively meeting. And have a good time at the BLM meeting.

Meeting Adjourned at 4:05 p.m.