HAWAIIAN ELECTRIC COMPANY, INC.

INTEGRATED RESOURCE PLANNING ADVISORY GROUP
TECHNICAL SESSION
CLIMATE CHANGE/GLOBAL WARMING

FRIDAY, JUNE 8, 2007, COMMENCING AT 8:34 A.M.
STATE CAPITOL AUDITORIUM
HONOLULU, HAWAI`I

Reported By: Valerie Mariano Swiderski, Hawai`i CSR #353

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OPENING REMARKS

Moderator, Dr. Mike Hamnett, Research Corporation of UH

THE MODERATOR: Good morning everyone. Aloha. We'd like to get started. We have a very full day.

My name is Mike Hamnett. I'm the executive director of the Research Corporation of the University of Hawai`i, and I'm also on the Advisory Group for the Integrated Resource Planning process and cochair of the Energy Policy Forum. I apologize. As I say, we have a very full day.

The purpose of this meeting, for those of you who don't know why you're here, is that this has been organized as part of the Integrated Resource Planning process. That's the IRP that some people don't know what it is, which is part of Hawaiian Electric's long-range planning, and it's a process that is sanctioned by the Public Utility Commission as a process for each of the regulated utilities in Hawai`i. We're here to find out, to learn about global warming and greenhouse gas emissions and how those things are related, and we're here to learn about the technologies that may be available to address that issue. And we're here to kind of help Hawaiian Electric to think about what to do with the whole issue of greenhouse gas emissions.

As somebody who's been involved in energy planning and in global warming policy work for about 17 years, I never thought I'd be here. I never thought that our society would give this kind of attention to greenhouse gas emissions and to global warming. There were people talking about this a long time ago, and it's now -- it's now actually starting to be talked about by Hawaiian Electric Company, by the U.S. administration, and by a whole bunch of people that didn't talk about this five years ago.

The agenda today, we have four panels. The -- the -- for those of you who have the agenda, you can see that the first one's on Background on Climate Change Issues. The second one is on Policy Implications for Hawai`i. The third one is Options and Strategies for Controlling Greenhouse Gas Emissions. And the final one is Incorporating Climate Change Into the Integrated Resource Planning Process. We do have a very full agenda. I've been asked to be -- to move this along, so I'm gonna ask the speakers to stay to their time, and my body language is such that people will know when they've run out of time.

Just a couple of issues that you need to be aware of. The young woman sitting down here next to me is a court reporter. Today's proceedings will be recorded. `Olelo will also be videotaping the proceedings, so if you don't want yourself on camera, I suggest you move to the back of the auditorium.

The format for the panel sessions, each speaker will deliver their presentation. Terry Surles gets the blessing of having 30 minutes. Everybody else has got 15, and then there will be a half an hour questions and answers at the end of each panel.

In terms of questions, there are these green sheets available. Please write down your questions and give them to folks to bring up here, and we'll go ahead and deal with those from here. Your handouts also include an agenda, speaker biographies, and a synopsis of the lunchtime movie. Also on the table outside there's an evaluation form that we would ask you people to -- ask folks to please fill out.

I'm now supposed to introduce Robbie Alm, who I don't know whether he's here yet. So in his stead, Kaiulani DeSilva from Hawaiian Electric Company.

MS. DESILVA: Good morning, and thank you for joining us this morning. Robbie got tied up with a conference call, so he will be joining us in a few minutes. But in his stead I just wanted to welcome you all and to acknowledge that this is a very important meeting for Hawaiian Electric Company. There's been a lot of recognition from our company and statewide about the importance of the issue of global warming and climate change, and I think this meeting is important in hearing from many sectors of our community about this issue and where our state wants to go with it. So we look forward to the discussion today. We want to really encourage everyone in the audience to ask questions. That is the purpose of today, is to get the discussion moving forward and to hear what the concerns are from our community.

From our company, and from Robbie's perspective especially, too, we are really looking at what our state can do to really develop our own Hawai`i model and to take a step forward in doing that today. It just starts a long process going forward.

We do want to acknowledge Senator Kokubun and Representative Morita for hosting us today and sponsoring this session here. And we'd like to acknowledge members of our Integrated Resource Planning Group, who is our advisory group in our long-range planning process, for being here today.

A lot of this session was really created thanks to some feedback from Henry Curtis and our Integrated Resource Planning Group. We tried to get everyone's ideas about how to formulate today and how to move forward with this discussion, so we want to acknowledge the Consumer Advocate, the PUC, our advisory group for helping us create today's agenda.

Later on today we will also be doing a tree giveaway, so for those who are interested in taking up a personal and individual step towards addressing global warming, we will be doing that later on with a hundred native Hawaiian trees that will be given away later on this afternoon. And we will be presenting each of our speakers with a tree in appreciation for your time in coming today. Overall, thank you for being here, and we look forward to the discussion. Thanks.

THE MODERATOR: Thanks, Kaiulani.

I'd like to ask the first panel to please move up onto the platform here.

I also wanted to recognize Nina Morita, Representative Morita, who's been a real leader both in the energy area and the environmental area. And she's been a real inspiration to people in the Energy Policy Forum, and I want to thank her for all her efforts.

The first panel is Background on Climate Change. We have four speakers. I've known most of them for quite a few years. Our first -- and their bios are actually in your -- in your packet.

The -- our first speaker is Terry Surles. Terry has several hats. It's like me. I have several hats. That's why Terry and I have so much hair, from taking them on and putting them off. Terry is now with the Hawai`i Natural Energy Institute as one of his hats. I've known Terry for a few years, and he comes from a long history of involvement in climate change and in greenhouse gas emissions. He did the -- he started his first greenhouse gas emission modeling in 1980, which is even before I got involved in the global change business.

Our second speaker is Dr. John Tantlinger from Department of Business, Economic Development and Tourism. Several of us have been involved in with what was the Energy Division and -- for several years. And I go back with John to about 1993 when we did the first Hawai`i Integrated Energy Plan.

And then finally, a close friend and colleague from the University of Hawai`i, Chip Fletcher. Chip and I have worked on natural disaster and erosion issues in Hawai`i for about 15 years.

So I'm gonna go ahead and turn this -- turn the microphone over to Terry to give the first presentation, and this is an overview of greenhouse gas issues. Terry, thank you.

AN OVERVIEW OF THE GREENHOUSE GAS ISSUE

Dr. Terry Surles, Hawaii Natural Energy Institute

DR. SURLES: I'm picking this up. Again, since Mike and I are somewhat follicley challenged, what he's gonna do to tell me I'm done is to shine a flashlight off the top of this head, and that will inform me.

Okay. So at any rate, I characterize this as a primer. And my classic line is from a -- my classic line is to -- is from a Second City Review in Chicago, which is, "See you real soon, and I'm off to the 30 Years' War." And I think you have to keep some humor about this because it is deadly serious, and it's at least a 30 years' war.

Now for those of you who want to go out and get a cup of coffee, this is my final slide. And the final slide is simply that the warming is unequivocal, and it's now evident from all observations, increases at the -- increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global mean sea levels that we're having -- you know, we're having a warming of planet.

And I'll talk about IPCC in a little bit. Their latest, their first report in six years, just came out in April, and I'll be talking to that in a little bit.

The other thing I'd like to point out -- and this is a slide that I've used in the past. And I think I appreciate that Mina has been willing to host this because I think public-private partnerships are critical, that if you're looking to the utility to solve this problem by themselves, they ain't; and if you're looking to the public sector to develop things on their own that's gonna solve this problem, they're not either. So these issues can't be resolved without partnerships. And I characterize this for some of the real -- on one hand, the real environmental zealots that says, we're gonna get a free lunch out of this. Well, we're not. You know, this is going to be expensive to get on top of, but it's like the Fram oil filter that if you don't start getting on top of it now, it's gonna cost a huge amount of money later for our children and our grandchildren. So pay me now or pay me later. We've got to get on top of this now.

So the main points of this, I'm gonna do a quick review of the basic science because it's surprising at times how many people really don't know what greenhouse gas effect is. I'm gonna talk about the IPCC report and actually kind of juxtapose that with what I characterize as some feelings and thoughts from Flat Earth Society folk and then -- and then some options that are available that Gary -- that Gary asked me to talk about. And I think and I talked to Henry Curtis about this. It's not we're getting information from other people. Hawai`i can be a leader on this. And I'm quite sincere about that, and I know a number of other people here are equally sincere.

Okay. Some history: As an old broken-down scientist and spectroscopist, John Tyndall who's spectroscopist who really quantified the greenhouse gas effect. And the greenhouse effect is simply we get solar radiation coming in in a variety of wavelengths, from just a complete electromagnetic spectrum. What gets radiated out to space from reflection -- and it's why we can see the Earth as we can from the moon and so on. We get most of this radiated out to space, but some of it stays in as heat. And that's because a number of these greenhouse gases absorb infrared radiation and effectively keep the heat in our atmosphere. So that's what the greenhouse gas effect is; simply put, that we absorb infrared radiation with certain gases that are in the atmosphere, and I'll talk about them later.

Now we are a greenhouse gas planet. Now granted, Mars is further from the sun and Venus is closer; but Venus has runaway climate change, if you will, because they're primarily carbon dioxide. But the Earth, if it wasn't for greenhouse gases, would be quite a bit colder, about, as it shows, 34 degrees C colder. And so, in other words, rather than being about 60 degrees fahrenheit as an average Earth temperature, we'd be a little below zero degrees fahrenheit as an Earth temperature. So it's not only the gases we'll be talking about, but water vapor is the most important greenhouse gas. And you might imagine as things get warmer, there's more water vapor in the air, and you get a more -- and you get these positive feedbacks.

Now the point of this slide is that it's not that some scientist woke up in 1990 and wanted a job in greenhouse gases predictions. But this -- we've been worried about this for a while, and the predictions have been being made since the 1880s. And a lot of the seminal work was done in the fifties by Roger Revelle from Scripps, leading to, during the international geophysical year 1957/1958, a setting of the Mauna Loa Carbon Dioxide Observatory with Charles Keeling setting it up. And Keeling just recently passed away I think within the past year or so.

And basically what we see is a monotonical increase of carbon dioxide in the atmosphere from the time we started this until current. And the reason it goes up and down is the majority of the land surface is in the Northern Hemisphere, and because of that, the -- in the growing season, some of the carbon dioxide is sucked up, and -- but in the wintertime it's released. So the peaks are wintertime; and the lows for every year are the summertime.

Okay. Now it's not only carbon dioxide, but it's methane and nitrous oxide, and these are all industrial -- related to our industrial activities or man-made activities. I think as some of you know, some of the methane generation comes from rice paddies, for example. So -- but it clearly is anthropogenic drivers, man-made drivers that effect the increase in these -- in these gases.

Now I kind of switched to an earlier slide because there were a lot of senate hearings on this. Senator Inhofe, who considers climate change a fraud, Congressman Barton -- I might say they're both from oil states, one from Oklahoma and the other from Texas -- and Michael Crichton, who's a science fiction writer, have been poo-pooing this; and effectively they brought in Dr. Mann, not to ask him how his science was, but to question where he was getting his funding and why he came up with these curves.

The point here is even though there are some people that question these concerns early on, effectively the technical people that questioned them have since all recanted, that these are valid, showing that there's been a significant increase just due to industrial activity in the very recent past.

So the point here is -- and I use this slide for something else -- where we really don't know what precipitation may look like in the mid latitudes in the future, because it's hard for our models to show that. But as you look at the lower graph, the uncertainty is not whether climate change will occur or not; it's whether the future is gonna be bad or worse. And a lot of times the nay sayers have got on top of this by saying, well, scientists can't agree. As you look at the lower slide, it's just -- they disagree as to the detail, not to the trends.

So the most recent information -- now the IPCC is the Intergovernmental Panel on Climate Change, and this is a multinational panel, multi-institutional panel established in the early nineties. I actually think the first meeting might have been in the late eighties. A lot of the infrastructure was established following the Rio de Janeiro Summit in 1992 and with the support, I might add, of the administration at the time, which was the Bush 1 administration.

So now I'm gonna get into some of the information we have now, and the information we get now is quite concerning, to say the least. It's getting worse, not better. We know that climate change is occurring. The amount of fossil emissions over the past half decade is increasing as compared to where it was in the -- in the 1990s. And so therefore, the radiative forcing of carbon dioxide has increased by 20 percent over the past ten years, past ten years we have data for, which is the largest of any decade in our last 200 years, meaning since the start of the industrial era where we start burning a lot of coal. So the global mean factors, as we can see, are actually rising faster with time rather than slowing down, and you can see the warmest 12 years have all occurred since 1990, and 11 of the 12 years have all occurred since 1995.

This is a little complicated slide, but the gist of this is there's a lot of anthropogenic forcings here. This is one of Jim Hansen's slides from NASA, and I take it many of you know Jim's been in the news a lot challenging the administration, that they've been trying to muzzle him. The -- basically the reds and the yellows and the oranges to the right of the one bar basically show these are four things that enhance the warming of the climate. And the others, such as aerosols, cloud albedo, surface albedo -- interestingly enough, as we convert forests to crops, we actually reduce the amount of climate change, interestingly enough.

So -- but overall, the net effect of anthropogenic forcings is a considerable amount, and so we can track this. And so we track this with our models, and the model shows -- the lower one shows that the solar plus volcanic, which is the blue line -- if we model only solar and volcanic issues -- volcanic, by the way, puts a lot of particulates in the air, and it causes solar cooling to a degree or climate cooling. But it shows, as we look at this, our trend lines, you can't -- you can't match the trend lines with what really happened modeling only natural activities, meaning solar and volcanic. But if you model all activities, meaning the anthropogenic and natural --

that's the upper graph -- all four things match the observations over a period of time. So the models on a global level we were pretty comfortable with now work pretty well.

So Gary wanted me -- Gary Hashiro wanted me to show some basically NASA slides. This is the trends over the past hundred years, and the surface basically shows that in most parts of the world it's been warming and more significantly so in the polar area. Interestingly enough, some pieces cool, such as the southeast United States. The -- there is -- although this, the global ocean -- I think Chip's gonna talk to this. There is -- clearly ocean levels are rising. At the San Francisco Golden Gate, it's risen seven inches over the past century. Also in the troposphere there is a conversation that some of the early information was showing a cooling, and we now -- the later information that's in the IPCC report shows that that's also warming.

Okay. So from a paleoclimate perspective, what do we have? We show that most certainly this is -- the warmth of the last half century is unusual for at least the past 1300 years and that the last time the polar regions were significantly warmer was about 125,000 years ago. So implications on things like sea level rise is -- if you get a lot of melting of, say, the Greenland ice sheet, you can see a significant, meaning on the order of 15 feet, sea level rise.

Okay. What are the projections for the future? These are different scenarios of all this, and I'm not going to go into describe them. As you see, the gray bands are all the error bars on where they might be. But the point is, is that we can anticipate a likely range of 2 degrees, 2 degrees centigrade; and in a high scenario, as much as 4 degrees centigrade. I have another slide that basically shows we can actually end up with higher temperature increases.

The temperature increases look like this. In the more modest scenarios, which are the top scenarios, we still see warming, particularly in the polar regions. In the more aggressive scenarios where we continue to burn a lot of coal and a lot of fossil fuels, we see significant changes in the polar regions, and basically everything warms up.

Okay. Now Gary also asked me to talk about something about precipitation and drought. I'm not gonna spend time going through this bullet chart other than point to the final two bullets that in the subtropics and the tropic region, with which Hawai`i needs to be concerned, you can anticipate more intense and longer droughts and desertification on land masses. And basically you can see the drought is -- has been increasing over a period of time, and we can see -- we expect that to continue to increase.

The other thing that should -- that was mentioned in the recent IPCC report -- this is an earlier slide that I think is more apropos -- is that while we don't really know much about how hurricanes are formed, there is a correlation between hurricane intensity and the sea level -- surface sea level temperatures. And as I told somebody in Southern Company Utility after Katrina demolished Mississippi, Mississippi Power & Light, how many more Katrinas do you want to deal with?

So what do we see from the projections for future changes? Anthropogenic warming and sea level rise is certainly going to continue for centuries due to the time scales associated with the feedbacks even if we stabilize the emissions and concentrations. Temperatures in excess of what we project will eventually melt the Greenland ice sheet; and as I mentioned, it can raise the sea level significantly and comparable to what it was 125,000 years ago. And it's certainly very likely that hot extremes and droughts in the tropics and subtropics will continue. And for the mid latitudes, significant precipitation events are gonna become more frequent.

Okay. Technology, policy instruments. Technology's the key, and I hope this afternoon some people are going to be talking about this. And technology needs to be linked to public policy. We're on a trajectory that takes us off the chart. And so if we even want to hit the red line in the middle, we need 75 -- by 2100, we need 75 percent of our electricity to be non-fossil, end use efficiency increases on the order of a percent a year, electricity generation being 67 percent efficient by 2050, and passengers vehicles at 50 miles per gallon. It's not just the utilities; it's what we do personally with our transportation. And we need other technologies if we really want to reduce things. So if we want to stabilize at 550 parts per million, which is double the preindustrial concentration, we need to be a carbon intensity, which is carbon emissions per gross domestic product, on the order of less than 10 percent of today by 2100.

So I say this is a carbon management challenge from the technology. There's no silver bullet, unique portfolios. I've listed some of them here. And we also need to track life cycles because some of the things we think are good are not so hot when you start really looking at the life-cycle emissions. Renewable energy, this is the big picture. EPRI does this update yearly. We're getting there with many of these, but the issues remain. And in fact, HNEI is working on some of the these projects.

Efficiency, we can do it with efficiency. This is one of our favorite ones, that the efficiency of refrigerators over time has increased drastically and, by doing so, has removed the need for many gigawatts' worth of electricity across the country. But the problem is that when this administration speaks to voluntary programs, the energy intensity improvements that we're getting right now because of efficiency in the United States on -- for energy intensity effectively track what the voluntary program is that the admission says, so basically a business-as-usual model.

Okay. Gary also wanted me to say something about sequestration. This is, simply put, in geological storage, putting carbon dioxide underground in primarily saline aquifers, although there could be some research activities that you could use in -- research activities you could take advantage of here in the state if you're interested because there is research going on with basaltic formations, although I don't know if they're gonna play out.

If we're going to seriously deploy carbon capturing storage -- you may see this as CCS -- we need to employ deep saline formations around the world because the other things we want to use, which is enhanced oil recovery, you know, depleted gas base and stuff just doesn't get us there. So it's an opportunity, but it's also something that we don't know is gonna work yet. And if we want to continue to use coal because of national security issues, we really have to look at this as an option.

Okay. Now there's a number of policy activities underway to address the problem. You all know about the Kyoto Protocol, and I have a slide next on the European Union. There is, within the United States, two big things to talk about: the RGGI, which -- the Regional Greenhouse Gas Initiative in the northeast, which is nine states, a variety of institutions coming together in a bipartisan fashion -- in fact, I should point out I've been kind of slamming this administration, but the mode of force beyond -- for crediting RGGI was George Pataki of New York, who's a Republican. So this is bipartisan we have to work on together. And I think most people that are gonna work on this from both parties are gonna want to do the right thing, and it's just people out of the oil patch are not enthused about doing this, or people out in coal country are not enthused about doing this. So the nine states and institutions are coming together in a bipartisan fashion. They've developed a program to go on line in January of 2009. They have a number of offsets in place. These -- I've listed a few.

However, there is some bad news, and one of the bad news is they're just focusing only on electricity. And I don't think that gets you there. You need to focus on all emitters of greenhouse gases. And the other thing that the utilities are concerned about is what somebody in western New York -- what's to prevent them from buying electricity more cheaply from First Energy or AEP from a plant that's located in Ohio? So that's the concern called leakage that they really need to address, and my feeling is they haven't grabbed a hold of that well.

The AB 32, a lot of you have heard about this in California. Once again, the good news is everybody agrees this is a problem somebody needs -- we need to deal with. The bad news right now is I think as it's rolling out -- and I'm frankly more familiar with this than I want to be -- is that there's a leap of faith here, that there's -- there's goals being set that have no reality to what other public policy instruments you need to put into place and what other technologies you need to put into place that are going to make this happen. And so the linkage is not there, and I frankly -- and this is a personal opinion. I don't think they put much thought into how they're gonna get at these goals in the same way that I don't think they're gonna achieve a renewable portfolio standard of 33 percent by 2020.

Okay. Carbon markets, one of the things we want to do with the new law here in Hawai`i is, as you develop these, you really need to have sourcing baselines. You really need to be able to quantify your emission sources, and you need to understand what your sinks and potential sinks are. That allows you then to get into cap-and-trade programs. The Kyoto trade has some under this. There is, again, the European trading scheme I'm talking about in a second. And this has worked rather effectively. The Clean Air Act passed under Bush 1 had cap-and-trade for sulfur oxides and nitrogen oxides -- do I need to slow down? Cap-and-trade mechanism -- okay. I'm almost done.

They have cap-and-trade mechanisms for sulfur dioxide and nitrogen oxide. And overall, while you can debate this, you're really racheting down sulfur emissions and nitrogen emissions in the country, and it's basically been a good thing that works effectively and economically effectively and allows you to achieve some environmental goals. Now for something ubiquitous as carbon dioxide, whether cap-and-trade would work I think remains to be seen. There are credit markets. The Kyoto Protocol has a clean development mechanism that allows developing countries to get in on some of these things, some of this in terms of trading reduced emissions for compliance purposes. And then there's also the Chicago Climate Exchange that is really under development. I think I would characterize this as still something that's emerging out of the box, but it's not clear to me that it's an appropriate model to go with for the moment, and certainly not for the state.

There's other volunteer schemes that work very well. The renewable energy credits that are now sold and traded are positive things to enhance renewed reductions in -- or excuse me -- enhance the production of energy by renewable means and, therefore, in most cases would reduce carbon dioxide. The problem here is additionality. If you're going to develop renewable technologies and put them in place, are we going to -- are we -- are we doing -- if we're doing this already because it's a requirement under regulations, then you don't want to also sell the credits because you're already doing it. You want to sell credits for something that's over and above regulatory requirements.

And then finally, the carbon tax issue, I think it's important to consider, but it's got to be fair to all economic sectors. It's one of the reasons that some utilities in the -- in parts of the United States are looking at possible carbon taxes, but they wanted to be fair to everyone, which obviously would include, you know, not only tax them but also tax transportation. It must be societally fair. Carbon taxes, on the face of it, in my opinion, will tend to be regressive taxes.

So the European trading scheme, I think the point here is that this is a cap-and-trade launch. It's gone through a lot of fluctuations, but it is the first of a kind that allows trading between nations, 27 nations, and it covers almost half of all of the emissions. And I think to get at that point over that many nations is a good thing. And I got this slide from Adam Diamant from Pepperdine.

Okay. So the final thing, kind of coming back to what I said, I think, again, it's much appreciated we're here today in the auditorium because it is not only about technology development and public policy and its -- the Integrated Resource Planning exercise, but how do we link all of those to make advances? And the issue with a lot of tech weenies, of which I hang around them a lot, is that they think you can follow the top line and get to new technologies. But my sense is if you're not involving institutions, public perception, regulations and other incentives, you're simply not gonna get there. You need to link public policy instruments with R and D.

We want to drive to a sustainable future. My feeling is Hawai`i can be a leader, that we have the resources here. I think that in -- as Mike said at the beginning, we have the will here to do it, and I think this is a kickoff that we can do it.

Well, warming isn't gonna wait. Will we? Thanks.

THE MODERATOR: Terry, that was really terrific.

Thanks very much.

I want to remind people that there are question sheets on the back of the packets that you picked up.

The other thing I want to remind the speakers, because we're gonna stick to the time, is that the slides will be -- the Power Point presentations will be available on the HECO website. So for those who don't get entirely through their presentation, that will be available. Also, you can pinch Terry's slides out of -- off that website as well. Again, thanks, Terry.

Our second speaker is John Tantlinger from the Department of Business, Economic Development and Tourism. I'm not sure what -- how many hats John wears, given the circumstance. But John's gonna give us an Overview of Hawai`i Greenhouse Gas Inventory. And his division within DBEDT has been sort of on the lead of trying to compile an initial inventory of greenhouse gas emissions here in Hawai`i, so John.

HAWAII'S GREENHOUSE GAS INVENTORY

Dr. John Tantlinger, State of Hawaii, Department of Business, Economic Development and Tourism

DR. TANTLINGER: Thanks, Mike. I missed what you said, but the court reporter got it, so I'll read it later.

Good morning. Aloha. And I do have a script. If I speak too quickly, I'll get you a copy. I promise.

I want to first thank HECO for publishing my resume, even though I'm not looking for another job yet, but we'll see how this presentation goes today, and particularly with so many distinguished participants here today.

I too want to acknowledge, of course, Representative Morita and the Public Utilities Commission, Consumer Advocate, and any other distinguished guests whom I can't see because of the lights being so low in the back.

You heard Mike say that my name's John Tantlinger. He's right. And I still am. This is a tough crowd. Giggles. All right.

But seriously, you know, I've known many of the energy stakeholders here in the audience today for many years, and you know that DBEDT is one among several agencies that support the state government's various roles in energy. And for those who may not be as familiar, allow me just a brief moment.

Hawai`i's State Energy Program is assigned to DBEDT's Strategic Industries Division. State law designates that our department director, Ted Liu, is the State of Hawai`i Energy Resources Coordinator, or ERC, and he is the Governor's cabinet-level energy advisor. Maurice Kaya is DBEDT's Chief Technology Officer and also leads the Strategic Industries Division and probably better known for many years as the leader of our state energy program. So on behalf of Ted Liu, on behalf of Maurice, who's also a member of HECO's Integrated Resource Planning Advisory Group, I want to thank all of you for the opportunity to speak with you this morning and thank HECO for inviting us.

So despite that very long-winded opening, the remainder of my presentation, Our Greenhouse Gas Inventory, should stay within our 15 minutes by covering the topics you see on the slide. I'll describe our Greenhouse Gas Inventory project just to provide some context and a general background summary of information on why and how we did the project. We'll look at a recent preliminary recalculation of the baseline inventory of those emissions, the estimates for 1990, and compare it with a preliminary estimate for 2005 emissions. They will be presented by categories and sectors, and they include, of course, the electric utility emissions.

HECO's invitation to DBEDT was to present the inventory of greenhouse gas estimates for Hawai`i. So that's our -- that's the purpose. It's a fairly straightforward descriptive briefing of the findings of that analysis. You've already heard from one scientist, and HECO's assembled a very respectable lineup of experts in the field who are far more qualified in the science. So my presentation's gonna stick very close to that fundamental invited purpose. And for those of you who know me, I believe this will be a bit of a departure from other presentations because I generally conclude with a long list of recommendations or next steps, but I'll just conclude with a list of a few resources for some additional information on the topic.

So the project in the nineties was conducted jointly by our energy program in DBEDT and the Department of Health's Clean Energy Branch -- excuse me -- Clean Air Branch. DBEDT focused on the energy sectors, and DOH focused on the non-energy emissions with its contractor, the UH Environmental Center. It was a two-phase project that paralleled the structure of the U.S. Environmental Protection Agency's competitive grant program.

So the U.S. EPA, state and local outreach program was awarding competitive grants in two parts. First, develop a statewide inventory of greenhouse gas emission estimates, and then -- and with that outline a program of statewide greenhouse gas reduction strategies. And then part two, phase two, states why Hawai`i had successfully completed a phase one grant, had, I think, a bit of a competitive edge when it came to the award of the phase two grant for developing a climate change action plan. And therefore, Hawai`i's project was fully funded by EPA, and they also provided assistance in the areas that you see listed on this slide. The project was part of a -- the project and the funding was a part of a nationwide U.S. Climate Change Action Plan. It was designed to help the U.S. meet its goals under the U.N. framework convention on climate change.

The Climate Change Action Plan focused on cost-effective emission reduction initiatives in all areas of the economy, and it focused primarily on cooperative volunteer efforts by government, industry, and the public. This plan, particular plan, was unrelated to the Kyoto Protocols that were signed later in December of 1997. And the convention framework set the emissions baseline at 1990 for evaluating reduction progress.

So the purpose of the project basically was to develop statewide 1990 baseline estimates of emissions from human activity. And the primary focus was on the three main greenhouse gases: CO_2; methane, which is CH_4; and nitrous oxide, N_2O. And that would be the foundation then for phase two planning and a first step for recommending emission reduction and mitigation methods.

Now the methodology that we used to develop the inventory is listed on the left-hand -- left hand of this slide, and the formulas -- part of the grant criteria was to use the formulas provided by the EPA to calculate the emissions. They were looking for a standard approach to calculating emission estimates. And global warming potential of both methane and nitrous oxide are significantly higher because gases have more powerful forcing radiation over a one-hundred-year time horizon that was used in calculating global warming potential. You've heard already from -- about that from Terry.

So global warming potential was then used to sort of normalize into CO2 equivalent for -- which is the general practice to provide a standard measure and report on the emissions. Carbon dioxide equivalent is then measured and reported in short times. So the assumptions on the right side of the chart begins with the factors that was -- that were used for these gases in relationship to carbon dioxide. Based on more science, EPA actually modified the factors more recently, as you've seen noted on the chart. And the data that we used was obtained for energy use along with the non-energy sectors that you also see listed.

CO2 emissions from -- one of the assumptions was that CO2 emissions used from locally grown biomass for energy production was assumed would be sequestered during the replanted growth process. The estimate does not include exported fuels or overseas fuel uses or military aviation fuels. Now these are fuels that are not used in Hawai`i; and therefore, this approach is actually consistent with the principles of Kyoto.

So I've gone through five slides, and you still haven't seen any emissions estimates, and that's what this slide's for. Now I don't expect those of you in the back of the room to be able to read all the notes on the right side of the slide from the projected image, but they're important, and when you do see copies of the slide, they're there just to give you an understanding of the assumptions and method that I've already generally covered.

The information is also related to how the data are updated; for example, by using improved data that we've been able to acquire since the first set of estimates. And these estimates also incorporate the updated GWP factors. So what the table shows are preliminary estimates of Hawai`i's baseline 1990 greenhouse gas emissions and estimates for 2005 emissions. It was calculated first as a working draft in January and then slightly revised just last month.

The percentage change between 1990 and 2005, we can see, in each emissions category and sector is noted in the far right column here. Now residential, commercial, industrial energy emissions show the greatest increase. And I think we really owe some of that to the fact that we actually have better data quality and more complete, so it contributed to a more accurate allocation of data among the emission categories. Those emissions include the use of utility and non-utility gas; non-highway diesel, gasoline, and propane; and distributor generators that use fossil fuels; CHP and several other stationary uses.

The electric utility sector shows the third greatest relative growth in energy emissions at 14.7 percent. It includes emissions from both utility-owned generation and from the IPPs for the fuel that they use to generate the power that they sold to the utility.

Ground transport emissions from the highway vehicle use increased 28 percent. Domestic aviation and marine emissions are from interisland aircraft and ship travel and to and from the mainland. That decreased by 4.2 percent. Primarily we think that's due to aviation aircraft efficiency, their engine efficiency. International transport fuel use declined significantly by 26.6 percent, and so the international aviation fuel emissions declined 30.1 percent, reflecting, we think, both the use of more efficiency aircraft and international visitor counts. Decreases in international marine fuel consumption, we think, also contributed.

Non-energy uses increased 14.4 percent, we think mostly due to landfill and wastewater treatment emissions and despite declines in agricultural and the closure of the cement production plant in Hawai`i.

So overall, the preliminary estimate shows that our total emissions in Hawai`i increased by 7.5 percent in 2005 compared to 1990. And this actually compares to a 16.3 percent increase in nationwide emissions as reported and estimated by the EPA. Now I'll tell you, DBEDT is not prepared to attempt to explain the reasons for the difference in the estimated emissions growth or the variance between Hawai`i and the rest of the country because considerably more analysis would be needed for us to understand and be able to explain that.

I want to emphasize once more, these remain preliminary estimates. I think it's important to note this is due primarily to functional and resource constraints on our program. I mentioned the initial program was a multi-year effort. It was very adequately funded. It was conducted by a team of professionals. In addition to DBEDT, DOH, UH Environmental Center, we got support from DLNR, Department of Agriculture, Public Utilities Commission, the counties, and several other supporters and helpers on that project.

I really want to acknowledge somebody who's not here today. He's on a well-deserved vacation, and that's Steve Albert. He's an energy planner in my office. He's been single-handedly working on maintaining as best he can these estimates and trying to keep the model as up to date as he possibly can. And another person I think deserves some recognition, and that's our research statistician, Doug Oshiro. He's our only energy data staff professional, and he's been working very hard to try to improve the quality and consistency of our data functions.

Now I think this comparison of emission categories and sectors is actually more useful to people like me who'd rather read a comic book than a novel. Jeez, this is tough. This is a tough crowd. Okay. With all these numbers, you know, I don't know -- if I don't use a little humor, very little humor, I'm afraid I might even go to sleep during the presentation.

But what these graphs illustrate is that even with what appeared to be significant declines in, you know, proportional energy-related emissions overall, the energy sector and electricity generation, ground transportation in particular, particularly because of their scale, still represent the vast majority of greenhouse gas emission sources.

With that, I think I'd be remiss, given our program, if I didn't mention that whether greenhouse gas emissions are regulated or not, our priority, state's priority on reducing these emissions we really believe needs to remain focused on increasing energy efficiency, expanding the use of indigenous renewable energy resources, displacing the use of imported fossil fuels, particularly imported oil, because it represents such a large share of our energy production. And we think it's really a no-regret strategy, that whether or not greenhouse gas emissions get regulated now, sometime in the future, there's no reason to wait to continue to aggressively pursue these strategies.

So before I conclude, as with any type of statistical estimations, there are limitations. You've heard what some of those are. There are assumptions that are used. And I think it's just important that I clearly state those in a presentation like this. When we -- here are just a few more.

When we did our preliminary update, we found that acquisition of new data was needed to increase the accuracy. We did that as best we could, but a lot of work still needs to be done on improving getting the right data. Data transparency could be a consideration. Let me just quickly mention that fuel data is confidential and proprietary under state law. It's possible, depending on the level of detail of reporting emissions, to be able -- to then back -- work backwards and be able to identify reporters, actual individual reporters of certain data. So a lot of care has to be taken there.

We're continuing to work with the EPA in improving the reduction of greenhouse gas emissions, particularly in clean energy. And we've joined among 14 other states with

EPA in their Clean Energy Environment State Partnership. Greenhouse gas emission reduction for Hawai`i is one of our key issues.

I wanted to also mention a related limitation of the particular models we're using because EPA experts noted just a couple of weeks ago in one of our teleconference meetings that these models were really developed to increase understanding and awareness. They lack the precision and -- from their perspective, and they designed the models. They lacked the precision for regulatory purposes. So resources permitting, we're going to continue to improve use of additional places to get some information.

I want to note that the inventory -- sorry, but it's not gonna be reposted on our web -- there's been some changes -- until June 15th, but it will be up there. Again, thank you all very much for this opportunity to speak with you today. And HECO, thank you very much for inviting DBEDT. Thank you.

THE MODERATOR: Thanks, John.

This is a real good start on -- I know the legislature just passed a bill that would require considerable more inventory work, and some resources will be made available to do that. But thanks to Steve Albert and John Tantlinger and the staff at DBEDT.

The final speaker for this panel is Chip Fletcher. Chip's with the UH Department of Geology and Geophysics in what I refer to as the School of Earth, Wind & Fire; but I think the dean calls it School of Ocean and Earth Sciences and Technology. So I've worked for Chip for many years. He's gonna talk to us about the Impact of Climate Changes on Shorelines in Hawai`i.

IMPACT TO HAWAII'S SHORELINES

Dr. Chip Fletcher, UH Department of Geology and Geophysics

DR. FLETCHER: Thank you, Mike. I'd also like to thank HECO and the Integrated Resource Planning Advisory Group for sponsoring the session today. This is very educational. Terry and John gave fantastic talks. I hope I'm up to the same task.

I'm going to talk to you today about sea level rise. The IPCC report that came out a few months ago, as most of you know who pay attention to that group, finished taking new science over a year ago, and so I thought I would focus on new research that has come on line in more recent times since 19 -- or, excuse me, since 2007.

There's been a double melting rate of the Greenland ice sheet that's been tracked using data that's only a few years old. The combined budget of -- of ice sheet dynamics in Greenland amounts to melting of 57 cubic miles per year. There's net melting of the Antarctic ice sheet, which is a new realization. The question had been up until very recently whether or not Antarctica would actually ameliorate -- excuse me -- counter sea level rise by gaining ice, but the most recent data indicates that it's actually experiencing net retreat of 36 cubic miles per year. I'm going to talk about each of these in a little bit more detail in a minute.

Global sea level rise has now been documented to exceed 3 millimeters per year. All through the 20th century the big debate was whether or not global sea level rise was 1.5 millimeters per year or as high as 2 millimeters per year. We never really settled on that question, and we put a couple of satellites up that have been orbiting for the last 18 years, and they are documenting now today this year a rate of rise of 3.4 millimeters per year. Now for the first time, just in the last few months, the uncertainty, the plus or minus value on that 3.4 millimeters per year, leaves 3.0 behind. Global sea level rises at 3.4 plus or minus .3 millimeters per year. So we are quickly leaving behind the rate of sea level rise that we experienced in the 20th century.

Continued heating of the atmosphere and heating of the water column also contribute to global sea level rise. The main forces on global sea level rise are melting of the main ice sheets in Greenland and Antarctica and also the warming of the water column, the warming of the oceans. As you know, as you warm something, it expands, and this leads to what's know as thermal sea level rise or steric sea level rise.

And I'm going to show you our most recent science that indicates a 1 meter rise is now expected during this century. I think this is a good planning horizon. One meter by the end of this century I think is an appropriate planning horizon and actually potentially a conservative planning horizon.

If we fulfill a 3 degree sea temperature rise this century, then it suggests, based on geologic evidence, perhaps as much as 3 to 6 meters of sea level rise. And that geologic evidence comes to us from 125,000 years ago when we were last in a warm period, an interglacial, which is similar to the one that we've been enjoying for the last 10,000 years which has lead to the rise of our modern civilization. The last time climate was like this was 125,000 years ago, and between then and now we've gone through an ice age. Well, then sea level was higher, and temperatures were slightly higher; and if we reproduce those conditions, then we're in for, you know, a 3 to 6 meter rise in sea level.

There are still major uncertainties in sea level science, but these latest results are significant in that they do not point in the direction of smaller rates of rise. They are consistent with the worst case of longstanding predictions. And the counter-arguments against this grow fewer and fewer. And so I think the prudent thing for us to do is to examine the evidence and to identify for ourselves what sort of appropriate planning horizon we should be moving towards.

This is a nice graphic showing Greenland ice loss. In pink is the area that was mapped as experiencing net retreat or net melting as of 1992. In red is new data experiencing net retreat of the Greenland ice sheet in 2005. In white is area that is still accumulating. There's a net amount of positive side to the ice balance there. This change from 1992 to 2005 represents a doubling in the -- in fact, excuse me, a tripling in the rate of ice lost.

Here's the data from 1979 to 2005. You can see that there's a lot of variability in the total melt of the Greenland ice sheet. There is this net trend with a slope on it, an upward trend indicating an increase in melted area in the Greenland ice sheet. But there is a high degree of variability here, and so from a purely statistical and scientific point of view, it's difficult to extract from this a rate that is representing a long-term trend, but now the data extend back far enough that the rate is significant. But continued monitoring is extremely important so that we understand the dynamics of the Greenland ice sheet.

The Antarctic ice loss is shown here. It's not a long time data set. It only extends back to 2002. And you might see in there a pattern almost of oscillation. There might be something of a cycle taking place here, in which case it's really difficult to say that we have yet established a long-term trend in Antarctic ice loss, especially given the short time period of our data set. So we're still watching Antarctica very carefully, and it's extremely important that we put up the instruments in the air to map this ice sheet carefully.

In Antarctica -- this is a map of the Antarctic continent. East Antarctica is still accumulating snow. These little -- these crosses are actually meant to be plus symbols. It's over here in the west Antarctic ice sheet that we see net retreat, and that's what these negative values are over here. So this is the area of Antarctica which we think is most vulnerable to heating in the atmosphere.

Thermal expansion is modelled again and again with various global circulation models as occurring on all of the oceans. Basically the hotter the color here, the greater the temperature rise, and you can see that the sea surface is participating in the warming that is taking place as well as on the continental areas. This is the temperature record of combined sea surface and land surface rise. You see it extends from 1880 to the present day.

Now we can model sea level rise, but a more empirical approach or a more direct approach is to look at our history of sea level rise and compare it to this history of temperature change. And so by comparing these two sets of observations, we have a relationship that would allow us to project sea level change into the future, if we assume some scenarios of temperature change. So this is our history of surface temperature. And -- well, there was supposed to be in there a -- a history of sea level change since that same time period, 1880. Maybe it's the next slide.

Let's discuss just for a second the contributions to sea level. Alpine glaciers and ice caps are another form of water storage that are retreating. Alpine glaciers and ice caps around the planet are experiencing melting, and their contribution to global sea level is on the order of half a meter, so they're relatively insignificant. The contribution of Greenland to global sea level is over 7 meters, and the west Antarctic ice sheet, the one that we're most concerned with, the contribution to global sea level was 5 to 6 meters.

Sea level rise due to ice melt versus to sea level rise due to thermal expansion, they each seem to account for about half of the amount of the sea level rise today. So melt water coming off the ice sheets and just the steric heating of the ocean surface seem to account for about half of our observed sea level rise. But overall it's important to say that the sea level budget is poorly understood. That is, adding up the contribution to global sea level rise from all these sources is very poorly constrained.

That's why -- and here's the missing slide. That's why using a more empirical approach where we track global temperatures and compare them to global sea level rise gives us a way to understand the future. So this has been done by Stefan Rahmstorf in a paper published just a few months ago in Science.

Here we have the rate of sea level change from 1881 to 2001. And here we have the warming from 1881 to 2001 compared to -- normalized to this mean. So by comparing these two, we can understand the response of sea level to atmospheric heating, and this is the result. The red line represents the smooth trend of sea level change. The blue line represents the computed trend by comparing or modeling with the temperature trend. And the red points represent the unsmooth data.

So based on this, a sea level rise of half a meter to one and a half meters is projected by the year 2100 given an IPCC temperature projection of one and a half to almost 6 degrees C this century. So if temperature rises as projected by the IPCC, then this would be the sea level response. So it's this basis that I recommend a 1 meter planning horizon. Basically falls in the mid of this -- the middle of this range.

So what is the impact of this 1 meter sea level rise here in Hawai`i? Let's look at a couple of scenarios. Let's take a 1 meter sea level rise. Let's make it at high tide, and let's add rain from last April; okay? Several days last April and March we had almost a foot of rain in a day, yeah?

One thing to remember, that as sea level rises near the coastline, the water table which sits on it under the land is also going to rise. So sea level rise is not just attacking the coastline. It's going to take dry land and turn it into wetland behind the coasts, up in the area where we drive and live and build our buildings. And wet land or even land that is perched only a few feet above the water table, when it gets rained on, is our only source of draining that rain away. So if the water table is high, rainfall won't be able to drain. It will turn into standing water, and we'll experience flooding based on this standing water.

This is already happening in Mapunapuna, the industrial district by the airport. The storm drains there feed into the ocean, and at high tide the ocean feeds back up into the storm drains. There is saltwater coming up out of the storm drains in this industrial area several times a month during high tide. When you rain on top of that, you develop standing pools of water. So I think this is what life is gonna be like in the second half of the century, is a major rain drainage problem.

Another thing that occurs in our waters is high peaks of sea level, such as this topographic map, this dynamic topographic map. In red and green you see what are known as mesoscale eddies. These are piles of water larger than the Big Island that have a sea level rise of about 20 centimeters, and they come through -- the come through all the time. The major ones come through every couple of years, and they reside -- as they pass through the Hawaiian Islands, they reside for a few weeks. So sea level is artificially high. To bring this point home to you, the waves at Ala Moana Beach Park cross all the way across the beach, and they hit that retaining wall next to the road when one of these happens at high tide, so these mesoscale eddies. I'm not gonna model these in my scenarios for you.

Another thing that raises sea level around here is our large swell. A 15-foot open ocean wave, which we get several times a year both from the south and from the north, will raise sea level as much as a meter against the coastline. This is called sea level setup. That's not the -- I'm not talking about the run-up of waves on the beach. I'm talking about a still water level that is basically the inertia of these waves, and it rises against the shoreline. So I'm also not going to include this, so I think I'm going to give you some sea level rise scenarios that are relatively conservative and perhaps under-predicting.

Okay. Here is Campbell Industrial Park. This is a major industrial center for the state. It is low lying. It's at Barber's Point. It's basically a coastal location. And we have topographic LIDAR data here that has a resolution of 20 centimeters, and so we can map what our high tide 1 meter sea level with a foot of rainfall will do here. And you'll see the coastal areas begin to flood. So I think this is the sort of map that should be the basis for analysis of where we want to be in the second half of the century. Now I'm not familiar with the infrastructure here in the coastal zone of the industrial park, but this is an area of high concern. Notice also that these hinterland areas are also experiencing conversion from dry land into wetland.

Honolulu Harbor and Honolulu, Sand Island, this area, it's amazing what the flooding does here. Let's look at this again. It turns out that the area around Ala Moana Boulevard is actually below 1 meter in elevation. Sand Island, where Sand Island processing plant, sewage processing plant is located, the harbor itself, all of these areas are vulnerable to this standing water effect. Again, notice that the coastline is not immediately attacked by sea level rise. It's this rise of the water table back behind the coastline that I think is of greatest concern.

Let's look at Waikiki. I'm sure you can predict that with the Ala Wai Canal back there, we have a very low-lying area.

Okay. What about beaches? Most of you are used to hearing me talk about beaches. Well, I think beaches are a thing of the past, frankly. I think in the second half of this century you're not really gonna have beaches. I think that with 1 meter of sea level rise, this is what our shoreline is going to look like. If you want beaches, you're gonna have to find sandy land and allow it to erode, and the beach would be the front of that sandy land that is eroding away. And I know maybe there's two areas in this state: Polihale Beach on Kauai and Papohaku Beach on

Moloka`i where we might still have some beaches under this scenario.

Will this impact tourism? Frankly, I don't think it will. Let's look at one case scenario right now. Here we have a typical resort, in this case in Maui. Many of our resorts now are building pool facilities that sort of replace beaches, and you'll notice there's really not much of a beach here. When you visit this area, you still experience the ocean, the climate, the culture. The beach is not really part of the scene. It's the pool area where most of our visitors are going. And, in fact, the beach in that area really has essentially disappeared anyway.

Well, what's happening is we're replacing our beaches with built beaches in the pool facility. That's a pile of sand. That's Texas stream gravel that we're now importing, and there's over a dozen resorts now where beaches are being brought into and incorporated into the pool facility. So I think this is really what our beaches are gonna look like in the future.

The problem with this is the locals lose. We're the ones who go to the beaches. We can't afford to go to these resorts. So I think that our coastal access and our local natural resource of the beaches is what the impact is there. And I want to thank you for the time you've given me.

THE MODERATOR: Thanks very much, Chip. Thanks to all the panelists.

Again, I would remind you that there are question sheets at the back of the packet you picked up when you came in. Greg is on this side. Leo's on this side. They'll be prepared to collect those and bring those up, and I will try to read those, and then we'll ask -- we'll direct it to the panel. We're gonna take just a one-minute break to allow the court reporter to rest her fingers and to allow you to write questions.

(Whereupon, a brief recess was taken.)

BACKGROUND ON CLIMATE CHANGE ISSUES

Question and Answer Session

THE MODERATOR: Okay. We have a couple of questions so far. First one would be directed to any one of the panelists who wants to take it: Will climate change affect temperatures and humidity in Hawai`i? If yes, when and how much?

DR. SURLES: The when and how much, it's -- I think it's -- it will certainly affect temperature, but again, as some of the IPCC slides showed, the major impact on temperature increases, it's going to be patchy around the world and certainly more -- the temperatures are going to rise faster in colder regions than they are in these latitudes, but you would expect it to go up a bit. You also expect that over a period of time that it would become a bit more humid simply because there's going to be more water vapor in the atmosphere because of overall higher temperatures around the globe.

How these occur, you know, I don't think you wake up one morning and say, my goodness, climate change is here because it's gotten warmer. I think it's just an incremental set of things that over a period of time people are gonna notice that things have changed.

THE MODERATOR: Good. Thanks, Terry.

Here's another question for Terry: If droughts will become more common for Hawai`i, why should we shift to growing biofuels?

DR. SURLES: That's a good question. You know, we talked about -- and I couldn't get into it in the technology section, but we really have to examine the life cycle of these new technologies we're trying to bring in. And certainly bringing in -- bringing in water-intensive crops for biofuels is potentially a problem. We've -- excuse me. We've talked about this in terms of the demand on water, on labor, on land, and these are certainly not trivial demands. So the idea, as somebody said, we're gonna be the Saudi Arabia of ethanol, is in my mind an irresponsible thing to say. The biofuels you could be looking at are ones that simply have less of a demand on water and -- but again, you still are going to have to balance them off to land and labor demands.

THE MODERATOR: Thanks, Terry.

A question for Chip: With sea level rise -- with the rising sea level, wouldn't there be greater evaporation leading to more rainfall? And I would say the corollary to that would be, with the temperature increases, wouldn't there be more evaporation into rainfall?

DR. FLETCHER: I think our rainfall comes principally from two sources: Kona systems that come in from the south and the southwest, and the aerographic effect, which is the trade winds which are forced to go up into high elevation due to our high volcanic mountains where the rate of condensation exceeds the rate of evaporation. I don't think that the sea level rise, given the aerographic effect, will have enough of an impact to change where that -- the rate of condensation versus evaporation shifts it's location. One meter of sea level rise is not going to significantly change the local rainfall pattern.

On a more regional scale, I don't think that we understand yet what the rainfall changes may be. What I have seen is a projection that the climate in Hawai`i will become more El Nino like and that -- not that we will experience more El Ninos, but that it will become more El Nino like. And we tend to have droughts, periods of drought, during more El Nino conditions. We tend to have more tropical cyclones, too.

DR. SURLES: May I just add, again, a lot of the global -- the general circulation models for the globe are now pretty effective in looking at these, but when you start talking about rainfall patterns on a more regional or local area, it's -- the slide I showed earlier -- it's hard to get agreement in what they're gonna look like, what things will look like in the future because the -- getting -- teasing out the variables and having an idea on a regional level is still pretty much a state of art and not a state of science.

THE MODERATOR: Good. Thanks, Terry.

Next question's for John: I understand that the 1990 greenhouse gas emissions data will be available on the DBEDT website about June 15th. When and where will the 2005 data be available?

DR. TANTLINGER: I don't know, but actually, what we can do -- what I was referring to was the report itself, the report that was issued in -- in the nineties. It's just a matter of mechanics with the website. But as far as the presentation is concerned, we can post it on the website as soon as our webmaster can do it. I'm not sure what HECO's plans are for these presentations, but --

THE MODERATOR: Gary's informed us that they will be posted on the HECO IRP website as well, so -- and those will be available in a week or so, Gary?

DR. TANTLINGER: There you go. That question was for Gary, not for me.

THE MODERATOR: Okay. Thanks, Gary.

For Chip, how will our ability to track and monitor the effect of global warming be affected by recent reductions in funding for NASA's satellite program?

Second question is, besides yourself, Chip, who is studying the specific effects of global warming on Hawai`i?

DR. FLETCHER: Well, I -- I can express a personal opinion, and I think that what's happening at NASA is -- is unfortunate. It's gonna be great to have a guy on Mars, or a gal. But from that perspective looking back on our Earth, it's not gonna be a pretty sight. I think that decreasing the funding for Earth-monitoring constellations and satellites is a big mistake, and I think that we should be increasing our funding and increasing our monitoring of the Earth environment and that that should be the primary -- a primary goal of the federal government. Whether -- I'm not trying to prescribe mission science for NASA, but somebody should be funding -- maintaining and increasing rather than decreasing our satellite monitoring of the planet.

THE MODERATOR: Thanks, Chip.

A question for Terry: I hear conflicting things on what greenhouse gas reductions today will have on future catastrophic changes. I've heard it takes decades for gases to get to the upper atmosphere. Other times I hear there will be a quick feedback response.

DR. SURLES: Okay. I think the question would be, had -- there's -- the conflicting -- what was the first part of that? The conflicting?

THE MODERATOR: I hear conflicting things on what greenhouse gas reductions today will have on the future.

DR. SURLES: Okay. Basically the -- the trend lines, because of -- I think you can say -- and the comparabilities with the chlorofluorocarbon rules that were passed under the Montreal Protocol, that these ended up in our stratosphere and upper stratosphere that would -- that then would tend to decompose and effectively destroy the ozone layer. And by controlling them, we can -- we can make advances in that, and that is -- that's something that -- the turnaround for that is relatively rapid. But I characterize relatively rapid as being in a few decades.

When you look at the carbon cycle -- and it's one of the slides that hit the cutting room floor when I was putting together the presentation. The circulation for carbon dioxide will be in terms of centuries. Because the ocean is undersaturated in carbon dioxide, most of the carbon dioxide we're currently emitting is eventually going to go into the ocean. However, there is a flux where at any given point there's carbon dioxide being released from the ocean into the atmosphere. So the net effect is even if we stopped the carbon, the carbon dioxide emissions almost immediately, there's a lag time that -- where we're going to be experiencing climate change anyway. And to get a control on this, this is why the goals of the IPCC and a lot of the international activities are to try to stabilize at 550 parts per million by the middle part of this century because they know it's kind of like turning a huge ship around. And once we do that, there's still going to be warming.

THE MODERATOR: Thanks, Terry.

This is, I guess, for Terry and for Chip. This is on sea level rise: The first speaker, Terry, indicated at least three times the sea level rise that Chip did. Please clarify.

DR. SURLES: You're the sea level.

DR. FLETCHER: I don't think that they're inconsistent with each other; they just may not be in the same timing framework. I think that -- my goal in talking about sea level is to present scenarios that are not so catastrophic that you throw your hands up in the air and feel there's nothing you can do. I think it's important to present realistic near time scenarios that we can feel that we have the technology and the community will to do something about.

The fear of a much larger sea level rise is very, very real. Not the fear, but the possibility is very, very real. I think you saw from the short time frame of our monitoring data for Antarctica and the high variability of the behavior of the Greenland ice sheet and the Antarctic ice sheet that we really do not understand those two ice sheets, and those two ice sheets are -- they are the catalyst. They're the triggers for a global sea level rise. We don't understand the two major effects on sea level rise, and so it is appropriate to keep in mind some of these more dramatic numbers such as 2, 3, 4, 5, 6 meters. They're quite possible.

DR. SURLES: Yeah, that, and I'd only add that I actually didn't think our numbers were all that incompatible. I know that Chip was pointing towards a meter rise over the century, but his slides also pointed to that if you lose the Greenland ice sheet over a period of a century, you're going to be looking at a 4 to 6 meter sea rise. And effectively, that's the point of the IPCC panels that worked on this, that that is what you might anticipate with that -- with the destruction of the Greenland ice sheet.

THE MODERATOR: Good. Thanks.

DR. FLETCHER: Can I say one more thing?

THE MODERATOR: Sure, Chip.

DR. FLETCHER: I think if we do experience a sea level rise like that, society as we know it today will change fundamentally, rapidly, and potentially catastrophically. I think those high sea level rise scenarios should be in everybody's mind, and they should be something that we all should all be thinking about.

THE MODERATOR: Thanks, Chip.

DR. TAYLOR: Can I follow that?

THE MODERATOR: Yeah, go ahead, Brian.

DR. TAYLOR: Just -- Brian Taylor from SOEST.

Just remember that the IPCC report very specifically did not in their projections -- they particularly excluded the scenario where major melting of the Greenland or Antarctic ice sheets was included. So they said at the time when they stopped the science collection about a year ago, we don't have enough information to know what's gonna happen to those ice sheets. They highlighted the fact that there was great uncertainty. That's why they weren't gonna put it in the governmental report. But they said, you know, this is highly likely. We're worried about it.

We're not gonna include it in our projections. That's why they gave the conservative numbers. But as both of these speakers have pointed out, they also highlighted -- you know, the next report six years from now I think is gonna say very different things. But they were very conservative by design.

THE MODERATOR: Good. Thanks very much.

Brian Taylor's the Dean of School of Ocean and Earth Sciences and Technology. Sorry.

Another one for Chip: Will sea level rise affect freshwater aquifers? If so, how, and what can be done?

DR. FLETCHER: I think this is a very important area that we need a lot more research in. Initially it will affect freshwater aquifers by causing them to rise. Those that are already near the ground surface, we will lose that amount of water because it will rise up to the ground surface and become wetland. We also have what's known as a caprock. A caprock is basically limestone around the south shore of Oahu which is thought to present a barrier between salt infiltration from the ocean into our fresh water reserves under the island, within the island. And the effectiveness of this caprock is poorly understood. As sea level rises, the tendency for salt to diffuse out of the ocean and into our groundwater resources is going to increase. And so there are very unknown and potentially important threats to the salinity, increases to the salinity of our aquifer system.

At the same time, as we draw down our aquifer -- and the Pearl Harbor aquifer has been declining for decades. As we draw that down, we are pulling up salt from below it. So -- and in fact, this problem's happening on Maui. The `Iao aquifer is actually -- the main freshwater resource for the island of Maui is showing chlorinity and salinity levels that are much higher over the last decade. There's a big discussion going on on whether the state government should take over management of the `Iao aquifer on Maui. There's a whole riparian management issue throughout this state that's very important.

Let me also just mention that -- you might think I'm going off topic, but I'm not. We are pouring millions of gallons a day of freshwater into the ocean through our antiquated irrigation system left over from sugar cane days. At the same time that we are drawing down our freshwater aquifers, we are dumping millions of gallons of freshwater through our irrigation system right into the ocean. The water management in this state is a very big issue, and it is tied to sea level rise.

THE MODERATOR: Good. Thanks, Chip.

A question for Terry: How does the U.S.'s contribution to climate change compare to other countries?

DR. SURLES: Well, is this because I was bashing the administration or what during some of my presentation?

The reality is, is that the United States actually puts a lot of money into research and technology development related to new technologies that would ameliorate emissions from fossil fuels. However, I agree with Chip's earlier statement that the things like NASA really needs to be focused on -- on the Earth. Basically it's the Planet Earth that's certainly something that Jim Hansen and NASA believes in.

The problem gets to the fact that our government, our current government's policies, are completely disconnected to what government scientists and government technology developers are doing, and that spills over, for example, the G8 conference at Rostock right now, that you really need to start getting at some mandatory requirements that the developed nations can agree to. There's just one nation standing in the way, and it's us. And my view is -- it's certainly an opinion -- is that there's gonna be additional monies for science and technology development in any new administration. Whether it's Democrat or Republican, I don't think it makes any difference.

I think the issue with NASA is a transitory thing that will be rectified. And hopefully it's -- getting to one of my final slides -- are public policies and the public policy instruments that we develop are going to be better linked to the science and technology we're doing. So that's kind of a speech. The side-bar is, again, this current administration was a disaster when it comes to any international relations with climate change.

THE MODERATOR: Good. Thanks, Terry.

I'd also just like to take a second to recognize Senator Norman Sakamoto who's come into the meeting.

Senator, thank you for being here.

Question for John: If greenhouse gas emissions source is clarified by sector -- yeah, is categorized by sector, can it be further by county or island? Can it be broken down?

DR. TANTLINGER: It can be. And that would take significantly more analysis to be able to do that because the way that the emissions were actually estimated is by using sort of gross fuel consumption methods by different technologies and sectors. So in some cases, some of the sectors are easier to isolate by county, say, for the utility, for example. And that's because there is more precise and more specific data for that. But for some of the other data, I mean, how could you necessarily apportion aviation fuel to a particular county? I mean, these things would have to be worked out, and I think it would require a significant amount of more work.

THE MODERATOR: Good. Thanks, John.

Question, probably for Chip, but more likely for Brian Taylor: Any effects on -- will climate change have any effects on ocean currents and jet streams?

DR. FLETCHER: Oh, wow. I can tell you that the ocean current in our harbors will change because of sea level rise, and that's something that we need to look at very carefully. Hawai`i has a standing foodstock in its stores of four days at any moment in time. We are rescued every day by Young Brothers and Matson with barges of food that come to us. And if we aren't able to properly dock those barges, as sea level rises and the situation in our harbors becomes more and more hazardous, this is a situation that needs to be looked at more carefully.

As far as the jet stream, I can't really comment on that. An atmospheric physicist would have to tell you about that. And as far as the -- what was the other part? Climate?

THE MODERATOR: It's --

DR. FLETCHER: Ocean currents. Yeah, actually, let me just segue for just a few seconds.

The School of Ocean and Earth Sciences and Technology has been funded, in fact, this year by the state legislature to start on ocean observing program here in the state of Hawai`i, and we have a coordinated group of scientists and technicians at SOEST numbering well over a dozen who are really going to be focusing on changes in oceanography, improvements in community resiliency, looking at the marine ecosystem, understanding meteorology of the state of Hawai`i. We are going to be studying over the next several years the potential impacts really of climate change as well as improving the products that we can deliver to the citizens of Hawai`i that are relevant to the skills that -- that's a good end to the sentence right there.

THE MODERATOR: Okay. We have four more questions, and we have four more minutes, three more minutes.

And this is probably for perhaps Terry: Would the use of biofuels, biodiesel, or other biofuels help improve the climate change situation for Hawai`i, the greenhouse gas emission situation?

DR. SURLES: Well, again, this is a life-cycle issue, but I think overall you're really going to be replacing petroleum products with -- with renewable energy products. So the net effect is yes. I mean, the other societal issues is -- are the question marks. I think the important thing here is more that you're improving your energy security if you're at least developing some of your resources here in Hawai`i. However, with biofuels, there are carbon emissions that are related to that life cycle, so it's not a completely free lunch.

THE MODERATOR: Good. Thanks, Terry.

What is the impact -- what is the impact of seawater air-conditioning on greenhouse gas emissions? Presumably we're on climate change in general. First, it raises up seawater temperature, but it reduces electric use. What will the overall consequences be?

DR. SURLES: That's for me?

I mean, for any technologies that are going to reduce electricity use -- and it's not -- I mean, I -- you know, we're -- you know, it's not a particular technology. There's a lot of new air-conditioning systems that are much more efficient than a lot of existing systems. So whether you're talking about seawater air-conditioning or anything else, it's just a matter of -- the key thing is if you can become more energy efficient, you're simply using less electricity, less petroleum products; and you, therefore, are going to be emitting less -- less greenhouse gases.

THE MODERATOR: Good. Thanks.

We're not gonna get through all these questions because I want to give people a break, but let's take one more.

How do grasslands, rain forests, and the ocean compare to rates of carbon capture per acre or square mile?

DR. SURLES: There's actually a very ac -- there has been a very active terrestrial sequestration program going on both in the Department of Energy and also in the -- in the California Energy Commission where these things are cofunded. I -- you know, I guess you'd almost have to refer to a Department of Energy Office of Health and Environmental Research website to look at, you know, what the latest results would be on that. I would not be aware of why one would be better than another at this point.

THE MODERATOR: Good. Okay. We're gonna have to cut off the questions here now if we want to get a break. It's just about a minute after 10:15. We're going to come back at 10:30. I wanted to ask you to help me thank the panelists for great presentations.

(Whereupon, a recess was taken from 10:16 a.m. to 10:30 a.m.)

THE MODERATOR: Okay. We're gonna go ahead and get started with the next panel, and this is Policy Implications for Hawai`i.

I have one housekeeping issue for those of you who haven't found the bathrooms. I think most of you know where they are now.

The other housekeeping -- the other housekeeping issue is Gary has asked us to have a show of hands of who -- to see, give a count of how many people will be here for the brown bag lunch.

Jim Roumasset, why don't you get up there.

So let me -- let's just wait until a few more people come in and sit down.

WOMAN IN AUDIENCE: Excuse me. What do you mean by be here? I mean, I'd -- I mean, I'd love to get some lunch, but I don't care where I get it from.

THE MODERATOR: Gary or Kaiulani, what are the arrangements for lunch? People get their own.

MAN IN AUDIENCE: Bring in some pizzas.

MR. HASHIRO: Yes, for the lunchtime for today, we do have planned a film showing in the Room 016, which is right around the corner here. And it's a brown bag lunch, so you bring your own lunch. And there is a snack shop that's right at the corner here where you can get lunch if you didn't bring any. We just wanted a show of hands to plan the logistics for that room to make sure we can accommodate everyone. Can I see a show of hands who plan to stay for the lunchtime showing? Okay. Great. Thank you.

THE MODERATOR: Okay. I'd also like to recognize Senator Clarence Nishihara and Gary Hooser who've also joined us. I thank you, Senators, for being here.

As I said, the next panel is on Policy Implications for Hawai`i. We have four presentations -- five: Environmental Perspective from Henry Curtis from Life of the Land; A Utility perspective from Robbie Alm; A

Legislative Perspective from Representative Hermina Morita; and An Economic Perspective from Jim Roumasset from the UH Economic Research Organization, and then question and answer. So we've got four presentations and then Q and A.

I will ask speakers to please limit themselves to 15 minutes, and I will also remind them and others that the Power Points will be available on the HECO IRC website.

I also want to make note and thank Henry Curtis. This is an historic day. This is Henry's first Power Point presentation. It took me awhile, Henry, too. Not quite as long as you. So without further adieu, I'll turn it over to Henry Curtis.

POLICY IMPLICATIONS FOR HAWAII

AN ENVIRONMENTAL PERSPECTIVE

Mr. Henry Curtis, Life of the Land

MR. CURTIS: Aloha. I think to start with this, money is a good place to start any discussion on climate change because there will be a great deal of money thrown at this issue by corporations, by non-profits, by governments, by foundations; and a lot of the money will come with strings, and a lot of the money will be used for good things, and a lot will be used for bad things. Follow the money, and it reveals all things.

And then I also like the term "truthiness," which is now part of the English language, because it refers to doing things from your gut regardless of whether it has any basis in reality. And one good example is from the public opinion polls. In the early nineties throughout the U.S. opinion polls showed that people were concerned with global warming. They thought it was real. They thought it was a threat. And the fossil fuel industry launched a campaign in the mid nineties to say, no, there's just a lot of skepticism about it. The science is out. It does not really exist. It may exist. And it was through the Global Climate Coalition which was funded heavily by Exxon and by the Edison Electric Institute, which is the trade organization for independently owned power utilities throughout the country. And Sinclair Lewis -- you may have seen this quote from films: It is difficult to get a man to understand something when his job depends on him not understanding it.

We've had a discussion by previous speakers about Greenland and Antarctica, and it's important to look at it as a percentage. If Greenland -- if 15 percent of Greenland melts, the reef runway goes under water. And what impact does that have on our tourism industry? What happens if a third of Greenland melts and our downtown business sector is under water?

The early message of the fossil fuel industry was, as I said, what, climate change, it's way too uncertain. And now, as the new message is, well, climate change is important, but we have a future based on coal. Coal is what exists throughout the United States. We have abundant supplies, so how can we have the coal and avoid climate change? We just have to somehow capture the CO2. It's never really been done before, but we'll find all kinds of uses for it, and everything will be okay.

And the biofuel industry has popped up. Initially their message was we'll offer an alternative to fossil fuels. We are gonna find biological solutions that are gonna solve our problem, and we don't -- and we'll go beyond fossil fuels. Along the way though, it -- the fossil fuel industry realized that agriculture is an extremely fossil-fuel-intensive industry, and if you increase it, there will be more opportunities for fossil fuel. And therefore, the fossil fuel industry is now not against biofuels because they don't see it as putting themselves out of business. They see it as a way of selling being green to the public and continuing their record profits.

And self-reliant proponents are talking about a variety of real alternatives, which include renewables, includes efficiencies, includes green pricing and smart meters. One of the things that we pointed out through docket with the Public Utilities Commission where we are arguing over proposed power plant by HECO that they wanted to build in 2009 in Campbell Industrial Park is that if you have a hundred acres of land, you can have a hundred acres of biofuel crops or 1 acre of solar and 99 acres of food. You get the same energy out of it. You just have a lot more food in the second scenario.

So we're at a crossroads right now, and we have many different paths. We can look at it as sort of a wheel, and we can travel down many different spokes on the wheel. The trouble is some of them are under water. There are many different paths. Some of them work; some of them don't work. The fossil fuel path is a denial of climate change. The biofuels path is fossil fuels coded green. A true portfolio involves a variety of renewables and efficiencies.

Some paths take us to places we need to go, some of the paths we got to stay away from, and some delay the day of reckoning. And we only have to look at past examples in Hawai`i to notice that Hawai`i, we have done -- gone down some paths that are less than desirable. After all, the mongoose was brought in to kill the rat, and now we have both. Miconia was brought here as an ornamental because it looked beautiful, and now it's rampaging through our forests. And the koki frog, we simply didn't take enough care to protect ourselves from invasives. We felt that the economic gain of plants were more important than finding out what the plants came with. The problem with climate change is we don't have a lot of time, and we can't be walking down different wrong paths, especially those paths that we know are wrong today but may be backed by money or special interests.

Dr. Shimon Awerbuch is a former senior advisor for the International Energy Agency. Unfortunately, he died in a plane crash this year. He talked about how -- Integrated Resource Planning procedures before the Public Utilities Commissions around the country. We have talked about renewables. We've talked about efficiencies. We've talked about regulation. But we have shied away from talking about what cost means, how you compare very different scenarios with very different risk streams. And these comparisons of alternatives have largely escaped any kind of analysis. They're decided in the back rooms.

Externalities refers to things that are not included within the price of a good. For example, if a power plant produces electricity and the fumes wipe out a local school, the impact to the school kids are not reflected in the price of electricity. And one way that businesses have of maximizing their profits is to shift their costs to society. If you have a choice of one power plant that emits low levels of greenhouse gases but costs more for electricity, you have another power plant that emits a lot more greenhouse gases but has lower costs, you can go with the one that has the greater impact on society but minimizes your own costs. Businesses throughout the country -- and I'm not singling out the electric industry, but all kinds of businesses throughout the country find it easier to maximize profits by shifting costs to consumers. When you buy a good at a store, you don't buy -- the company doesn't sell you a microwave and say, oh, by the way, when you're done with it, bring it back to us, and we'll dispose of it. The cost of disposing of it and what happens with the landfill impacts are shared by society.

This slide is a question we asked the Consumer Advocate during the power plant docket. And it's significant because biodiesel, for example -- if you grow palm oil in Indonesia and you grow it by destroying a rainforest, burning through peat soil, growing palm oil, turning it into biodiesel and bringing it to Hawai`i, taxpayers pay a dollar a gallon subsidy. Imagine what happens if we destroy rainforests throughout the world to grow biodiesel for the United States to use in power plants. Taxpayers pick up a huge load for destroying the planet.

And so our -- should the Consumer Advocate be reflective -- look at both the taxpayer and the ratepayer impacts. And the Consumer Advocate, part of the old thinking said no, we're concerned only with ratepayer impacts. And part of our roll at Life of the Land is to shift the focus to the new way of thinking. It says you have to look at things holistically. Mother Earth wants to know the total amount of greenhouse gases coming up into the atmosphere.

And part of it is the boundaries and limitations of any analysis. For example, Robbie Alm pointed out that HECO has actually reduced their amount of carbon emissions over the last 17 years, but they have increased the amount of power they buy from others. Cars spew toxics out of the tail pipe, and you often hear the analysis that this car has less emissions out of the tail pipe than this other car but not how much emissions comes from making the two cars or how much electricity or how much greenhouse gases are released in building buildings as opposed to operating them. Part of it is to look at the life-cycle analysis and not limit it or segment it to one section.

Okay. We've talked about Indonesia. Brazil is another example. The soil, the sugar production is not occurring -- where they're making ethanol is not occurring in the rainforest, but they're rapidly expanding agricultural areas and forcing other crops to move into their Amazon rainforest. So although the ethanol is not directly contributing to greenhouse gas releases, it's indirectly attributing to greenhouse gas releases.

One of the great areas of uncertainty deals with agricultural lands. The last area tackled by the EPA on water pollution is non-point source pollution. It just runs off fields and out to seas, damaging reefs and water systems. Greenhouse gas emissions are the same way. They are the least understood when they come from agricultural sources.

And we often hear two faulty assumptions: one, that biofuels are carbon neutral; and two, the fossil fuels should have a carbon tax of nothing. And it's nothing for the carbon tax, is the way we currently plan electricity in the IRP process on Maui, Kauai, the Big Island, and Oahu.

Economic input/output models are used by DBEDT and economic planners to look at how -- when you go to the store and buy something, how it ripples throughout the entire economy. Obviously some of it is used to pay for employees. Some of it goes to stockholders. Some of it goes for rent. The store has to replace whatever you bought. There are economic ripples throughout society. And there are economic tables that say that a dollar invested here will have two or three dollars of economic activity. We need to begin thinking about the same thing for greenhouse gases, how an action in one place ripples throughout the economy and what the total greenhouse gas emissions result from that action. And the Japanese have actually begun to look at that, and there are other players around the world who are beginning to think of this.

The second is life-cycle analysis, and I'm glad that Dr. Surles mentioned this. This deals with looking at a product from the time you take it out of the ground, you mine it, you process it, you make whatever you're doing, and you landfill it or you recycle it.

And this example comes from Carnegie Mellon where they analyzed the energy use and the toxic use from cars over the lifetime of their vehicle. And you can look more at this from the slide presentation when they're posted up. This looks at how the life-cycle impacts of cars, electric cars, depending on whether the electricity comes from coal, liquefied natural gas, or hydro, because it's not just making the car, but it's how you power the car if it comes from electricity.

So I want to look at three different scenarios from this kind of a context. The fossil fuel scenario, we take fossil fuel from Indonesia or anywhere around the world, and we refine it at Chevron or Tesoro. They're ranked 5th and 8th, respectively, in toxic emissions in Hawai`i. Then we burn it at a power plant. Kahe ranks number one in the state in emissions according to EPA.

Ethanol, we could make it from Kauai Ethanol. They propose that each gallon of ethanol they make uses 4.18 pounds of imported Australian coal. And the coal accounts for 60 percent of the energy content of the ethanol, but the ethanol is 100 percent green under state law.

The third is ocean power using a combination of seawater air-conditioning and ocean thermal energy conversion. Then under state law the first is entirely fossil fuel. The second and third are entirely renewable, even though all three systems use fossil fuel, and all three systems emit greenhouse gases.

So a life-cycle analysis would say, let's look at a number of the major processes that are used in each of the scenarios. And let's look at the greenhouse gases emitted in each of those steps. And let's create a common unit: tons of CO2 equivalence per megawatt hour of electricity produced or displaced over the life cycle of the facility or process. By doing that, we have a basis for comparing the real impact from different scenarios.

I like this quote from Carl Sagan: Anything else you're interested in is not going to happen if you can't breathe the air and drink the water. Don't sit this one out. Do something. You are by accident of fate alive at an absolutely critical moment in the history of our planet. Remember during the last -- all ice ages this planet has ever had, nothing larger than a house cat has survived. And this is how you can contact us for more information. Thank you.

THE MODERATOR: Henry, great Power Point presentation.

MR. CURTIS: Thank you.

THE MODERATOR: I'd also like to recognize Senator Russell Kokubun who's joined us this morning.

The next speaker is Robbie Alm from Hawaiian Electric Company. He's going to give us a utility perspective. Robbie.

A UTILITY PERSPECTIVE

Mr. Robbie Alm, Hawaiian Electric Company, Inc.

MR. ALM: Thank you. Good morning. I want to begin by saying that our board of directors and our management team fully accept the challenge of global warming and our role in the work that lies ahead. Specifically, the company accepts the reality of global warming and the responsibility we as a company have to take direct action to reduce the contributions that electricity production makes to global warming, which it clearly does.

We supported adoption of the greenhouse gas legislation this year. We will assist the work of that task force in any way we can. And we firmly believe that the work that we all engage in in coming years lies -- in that work lies a great opportunity for Hawai`i to reduce and ultimately eliminate our dependence on overseas fossil fuel sources. We must act expeditiously, and we must act with skill in terms of how the greenhouse gas law will impact our people and our way of life. We do not have to chose between speedy action and skillful action because we actually have the resources as a community to make this happen.

First, as many have said, including John this morning and including Maurice Kaya in the past, we need to continue to do everything we're currently doing in terms of renewal of energy and energy efficiency. Maurice and John have both used the term a no-regret strategy. That is absolutely true. There is no calculation on greenhouse gases that does not make work in energy efficiency and renewable energy valuable work. So we need to continue that. We could do that at full speed while the task force looks at other activities.

So as we look at the next few years, what things do we perceive? Right now there are four wind farms on our system. We expect between two to six more wind farms joining our system in the coming years. We do expect to place into service in 2009 a fully a biofueled power plant. We expect to substitute biodiesel for petroleum diesel in our Maui system, thus converting the core on the Maui system from oil to renewable. We do expect an expansion of geothermal on the Big Island, initially by 8 megawatts, and later the discussion is of an additional 22 megawatts.

We believe there is substantial power available in the forests on the Hamakua Coast, and we would hope to see that potential realized. We expect to see an additional amount of power derived from the waste stream on Oahu as Oahu completes the bidding process to decide on the future H-Power. We are also working with both ocean and current energy developers to see what is available in our oceans and to exploit that, and I think we are going to -- we need to continually aggressively examine the opportunities for energy storage such as to those that come from battery or from pump hydro systems. There's literally hundreds of megawatts of renewable energy that lie in our future.

Though it will not necessarily be easy, we must overcome NIMBY-ism. We must accept alternative energy resources in each of our communities. This is not somebody else's problem. We must find beauty in the look of devices that get us away from oil. And that really is on each of us, and none of us should shirk from the task. When renewable energy proposals are made, it is in everybody's interest to speak up in favor of them.

Along with renewable energy generation, we have great resources for the substitution of generation such as seawater air-conditioning. There is a proposal that is working its way through to install a good-sized facility in downtown Honolulu. That project needs to go forward. We've been supportive of it. We're signing up for it. We have urged our clients to sign up for it. If you have any influence on any building in the downtown area, urge them to sign up for it. And then there are the critical energy efficiency programs. From solar roof to rebates for energy efficient equipment to the use of compact fluorescent bulbs, we can all do our part in that action whether we're talking about commercial enterprises or residences.

Secondly, beyond the direct action of our no-regrets work with renewable energy and energy efficiency, we need to look at general mitigation strategies such as reforestation, the greening or regreening of Hawai`i. We have a climate for it, and studies have suggested if you're gonna plant a forest, you want to plant it in a place like this, not in other places on the planet where it actually may not be a plus; it may even be a negative. It will add obviously to the quality of our life, to the attractiveness of this place, but it should also add to our water resources and have so many other benefits.

There are some uses, some greenhouse gas emitters we are really going to struggle in dealing with. One of them is jet fuel. There simply is no way for us as a state to directly impact jet fuel, and yet our state's emission count includes jet fuel. So if we're going to mitigate, we can't just mitigate directly at the uses we have. We have to figure out some broader mitigation strategy that can lower our overall number.

Third, we need to take across-the-board action at all greenhouse gas emissions. We must go after all emitters and make them responsible for their actions. And in Hawai`i one of the key areas, as the numbers you saw earlier show, is transportation. Transportation simply cannot be let off the hook. That one's going to require work. It deals with our favorite automobiles, and that means it involves each and every one of us. The number of cars on this island, on all of our islands, is a real challenge.

Our diesel fleet truck use is B20, a biodiesel blend. A lot of the company cars we drive are very high mileage Neons. We all have to think about the individual choices we make in the cars we drive. You know, it would be great to ask everybody in this room, who drives either a hybrid or a high mileage vehicle or uses public transportation or bikes or walks as a regular activity? That's great.

That's about half the room. The day should come when every single hand in this room goes up. The fact that we drive some of the vehicles we do when most of us drive a few miles a day at speeds which can never really exceed about 55 or 60, just because we don't have the ability to drive at those speeds because of the traffic around us, suggests that we're buying a lot of vehicles for which there's absolutely no use except perhaps our own ego.

We need to look at our home consumption of fossil fuels. We are driven in this state more by residential use than most places, so much of the answer must therefore lie in our homes as well.

How do you change behavior? What combination of education and incentives will make this happen? We believe in education and have taken to the media with programs designed it do exactly that, but much more needs to be done. We are going to the schools beginning this fall to work directly on the issue with young people. Harnessing the power and commitment of the youth of Hawai`i -- excuse me -- is one of our strongest assets. Not only is their influence over parents and grandparents very strong, but if they grow up with a different attitude towards energy use, in other words, the absolute requirement to use less, those habits will carry throughout their lives.

Four -- and here is the expressly skillful part -- we need to design our law with great regard for how it impacts us. One of the impacts of greenhouse gas regulation that is clearly intentional is to raise the price of fossil fuel uses in order to truly price their impact, as Henry noted, but also to discourage their use.

How will this impact different people? What we don't want to do is balance this equation on the backs of poor people. That's not good enough for us as a community, and the law clearly requires that be examined. We need to provide ways that the incentives for action that reduce our fossil fuel reward those who reduce it in such a way as to mitigate those additional costs. That sounds like a big circle, but what we really need are that if you as an individual choose to be energy smart, the incentive structure created under our law should reward you so that the impact to you of those rising costs is lessened. If you choose not to live energy smart and to waste energy, then the full weight of price increases should fall on you. And that's a matter of design. That's a matter of design of regulation. It's a matter of design of incentives. One of the core responsibilities of the task force in that new law is that work, and we should get on it with it.

Fifth, we want to ensure that the capital accumulated by greenhouse gas regulation stays here. We are a capital poor community, and we send already too much money offshore to buy fuel and food. As we raise additional sums through regulation, carbon tax, cap-and-trade, whatever system we use is going to increase the amount of money we collect. We need to make sure that that money is spent here, that it is recirculated into our economy.

Let me give you one example. It's been said that if we spend money on reforestation, it doesn't matter whether we spend it here or in a forest halfway across the globe. That's not true. We want, as we reforest, if that's one of the things we choose to do, to buy our plants, hopefully native plant, from Hawai`i nurseries, planted by Hawai`i people, maintained by Hawai`i people, greening our lands and helping our water table. And we can do this, but again, it takes deliberate action in the way we structure our regulations and our incentive structures. But we want the money we raise from people here to stay here in this economy.

Sixth, and finally, we have a great advantage in the work that lies ahead, and I think sometimes we forget this one in this community, and we shouldn't in this case. We have the University of Hawai`i. Some of the talent that's on the programs today and that we will find in -- some of that talent is on the program today. But we're gonna find in the coming days and months that we actually have an extraordinary, talented group of scientists and professionals who are world leaders in their fields gathered here in this room. Whether by accident or design, some of the best minds on the planet to deal with issues of greenhouse gas and what we should do, we actually already have here. Outgoing UH Chancellor Denise Konan established a Manoa Climate Commission. Look at the membership on that list. It is -- it is an immensely talented group. And I believe that if we find the right ways as a community to call upon that talent, Hawai`i really can both lead the world in the way we look at this and hopefully lead the world in the way we approach it.

It is a great work that lies ahead of us. It is a great work in terms of the amount of work. It is also a great work in terms of what we need to do. It's critical for our way of life. It's critical for our very fragile land, which Chip showed about as well as anybody can. It is also work which we have the skill to accomplish. The question, as always, with this kind of work is do we have the will to action accomplish it. And that's very much dependent on the people in the room. That's dependent on each one of us individually, and we pledge our part in doing this. Thank you.

THE MODERATOR: Thanks very much, Robbie.

We're gonna go ahead and move on to Representative Mina Morita. As I said earlier, she's been a great champion both of energy efficiency and renewable energy, but also looking at the whole climate change issue. So a legislative perspective from the Chair of the House Committee on Energy and Environmental Protection. Mina.

A LEGISLATIVE PERSPECTIVE

Representative Hermina Morita
Chair of the House Committee
on Energy and Environmental Protection

REP. MORITA: Thank you. Good morning. My presentation is really short. I was -- I wanted to be here to field questions. It's really interesting because when I first started looking at energy issues in 2001, I did not agree with anything someone from HECO would be saying, and I think it sounded like I wrote Robbie's speech.

But I think the biggest challenge from a legislative perspective is climate change and energy policies are long-term strategies, and how do we sustain the political will to meet the policy objectives and implementation road map to achieve the desired goals, because we're looking at a road map that will take us 50 years or more out to get us to where we want to go in Hawai`i.

And, you know, I think the legislative perspective should also be the moral perspective. I remember when we were discussing the bottle bill in 2001. There were three students from Moloka`i -- and I tell this story often 'cause it really was a turning point in my legislative career. There were three students for Moloka`i that were 10 and 11 years old. They were fifth and sixth graders from Kualapuu School. And there was a room full of adults. Mostly the room was crowded by lobbyists representing national lobbying groups like the National Soft Drink Association, Anheuser-Busch, just really, really big names. And this ten-year-old girl got up, and she looked everybody in the eye, and she said, when I grow up, I don't want to be stuck with your problems. And, you know, this is the issue. We're trying to change that. We have an obligation, a moral obligation, as all of us probably saw Inconvenient Truth, to future generations in not leaving them with our problems. So -- so the political will -- and the biggest challenge is how to sustain this political will for moving in this direction.

The legislature took action this year, and thanks to many of the legislators in this audience. Senator Hooser, Senator Kokubun, and I think Senator Sakamoto worked in getting some guidance dealing with greenhouse gas emissions to the passing of House Bill 226. And the bill can be broken down into several core sections. One is the policy statement. And the policy statement by January 1st, 2023 should reduce greenhouse gas emissions to 1990 levels. So update the 1990 greenhouse gas emissions inventory; the formation of a task force to see how to do this in the smartest way possible; and then the rule-making process, to implement meeting the policy objective.

And, you know, this -- this was a small step, a small effort in the right direction. But if you look at all of the other legislative issues that are -- that are tied into climate change -- disaster preparedness, drought mitigation, coastal preservation and addressing coastal hazards and wastewater management or water management in general -- you know, all of these are pending -- are related to this very topic in some way. So, you know, it's overwhelming. So it's, you know, always a constant reminder of how to sustain the political will to move in this direction in a really complicated subject matter.

You know, in -- a lot of this is linked to technology, and a lot of it is linked to how do we deal with these kinds of complex issues in a new way. Definitely what we see here emerging, it's not a new way, but it's sort of a reaffirmation of the critical link between the University, policy makers, and the private sector in resolving this issue.

You know, on the national/international stage, we're looking at new forms of governments that -- regional management of emissions. We're looking at what will -- a global perspective of this problem and, you know, how public policy is linked to research and development. You know, so it's -- it's a little bit more complicated, and it will take the legislative initiative to set out the policy guidelines to get everybody moving in the same direction and addressing these issues. But I think we keep moving in the same direction by recognizing that this is the moral issue of our generation, that -- that it will take unique partnerships now to get everybody focused.

So as that ten-year-old from Moloka`i so wisely advised all of us, that when they grow up, they don't want to be stuck with our problems. Thank you.

THE MODERATOR: Thanks very much, Mina. I really appreciate your sentiments on that.

The final speaker of this group is Dr. Jim Roumasset from the UH Economic Research Organization and the Department of Economics at the University. And Jim's gonna give us -- I guess it's an economist's perspective as opposed to an economic perspective. Jim.

AN ECONOMIC PERSPECTIVE

Dr. Jim Roumasset, UH Department of Economics & UHERO

DR. ROUMASSET: I'd like to thank HECO and the Advisory Group for organizing this informative session, and

I wanted to acknowledge Dr. Burnett and Chris Wada sitting in the third row there who helped me put together this presentation.

I was asked to give an economic perspective, and since economics is a policy science, it's natural for me to focus on a couple of legislative initiatives. First one that Representative Morita just mentioned is HB 226 to reduce carbon emissions to 1990 levels by 2020.

By the way, I haven't heard anybody raise the issue of why Hawai`i should be doing this. There will be no impact within our lifetimes for what we do, and then there will be no noticeable impact on what we do since we're such a tiny part of the carbon emissions of the planet, and it's the planet emissions that matter. So the case for taking action is, one, a moral one. It's the right thing to do. And -- if one believes that. And the other one is a matter of leadership, that California decided to take the bull by the horns and proceed with a -- this kind of a program, so maybe if Hawai`i does it and a few other states, we'll start a movement in that direction.

These are the aspects of the bill that Representative Morita already mentioned, the membership of the task force and what they're assigned to do. Notice that one of the requirements is that the strategy that the task force is to come up with is to articulate cost-effective rules and market-based instruments. That's gonna be important as we move forward. It's the DOH that will implement this, establish the limits, and monitor and enforce compliance and work with DBEDT to update the inventory.

Now one issue is, What do we mean by update? I think that's an important issue for the task force to consider, and it's important that political considerations don't become part of that process. There's a big temptation for firms to get their 1990 benchmark moved up a little bit.

Now whenever you have a market-based incentive for carbon reduction -- and we have the experience with Kyoto Protocol and the leadership of the European Union and now California that have gone in the cap-and-trade direction, you really have two instruments to use that are market based: tax or quantity.

The trouble with a carbon tax is if we're shooting for 1990 emission levels, we don't know what price to set; and for this reason, most entities are going toward the cap-and-trade approach. So what you do is set a quantity for the identifiable sources of emissions, gradually reduce that cap to the 1990 level, and let people trade. Those that choose to emit more than their cap have to buy the permits on the market. And the market sets the price, so we don't have to know what it is in advance, since we don't know.

I mentioned already how to do the inventory is one important issue.

Now another issue is -- a choice to be made is do you give away the initial allocation? One problem with that is suppose that an industry has already reduced emissions because of the desire to be more energy efficient. So are you going to give them entitlements according to 1990 levels if they've already reduced below that? If you do, they'll get windfall profits.

The reason that this cap-and-trade is advocated is that we automatically get cost-effective compliance, that you equalize marginal avoidance costs across firms. Now the other option is -- which is politically more difficult, very attractive for taxpayers, is to auction the permits, and the revenue can be used to reduce other taxes. So if we're gonna pay cap-and-trade with the regulated sources, here's some of the regulated sources that you might think of. One of the difficulties becomes with small business, how small do you go? So there has to be a line, and there's going to be some unregulated sources.

So now we have three ways of meeting the 1990 target. One is reduce emissions among regulated sources. The other is reduce emissions among unregulated sources. One of the things that's done in the Kyoto Protocol is that a country wishing to reduce or comply with its target can develop a program with, say, China to reduce their emissions. Since it has the same effect globally, it's efficient for them to get credit for that. The administration of this kind of program, of course, is a little more difficult. How do you -- the benchmarking requirement, if it's already difficult to benchmark emissions, this one is a little bit more difficult.

Similarly, for -- if you want to have incentives to offset credits -- to give offset credits for sequestration, again, the benchmarking is very important. You want to incentivize someone to plant a forest, go into renewable forestry, sequester carbon that way, but you need to benchmark. And there's kind of a tricky issue of what if they were going to do that anyway? Should they have credit for it or not? Right now the legislation -- the language doesn't distinguish these three, so I'm not sure that would be a topic further legislation, something for the task force to take up.

Another legislative initiative I presume which is now law is the renewable portfolio standards. We're trying to read this the last week. It's not easy to make sense out of it, but the requirement is that by 2020, 20 percent of net electricity sales must be represented by renewable energy, and the "represented" is tricky. So it turns out that only 10 percent of the -- half of that 20 percent comes from actual generation, for example, H-Power. The rest can come from, quote, renewable savings, heat pumps, solar water heaters and so on that replace energy-using devices.

Now unlike the benchmarking system, it turns out here that you can count solar water heaters, for example, that were already installed 20 years ago as part of the compliance. So by 2010 you have to do half -- you get halfway there, so only 5 percent from generation. And we're actually already there, it looks like; that renewable generation of electricity is around 6 percent, and if renewable savings of the type I just described is at least 4 percent, then we've already made the target. And if the initiatives that Robbie Alm was talking about go through, we'll actually be quite ahead of the target.

Now what an economist would say as opposed to mandating reforms is efficiency pricing, and this has been already mentioned. One technique is that you want to incentivize individuals by charging the marginal costs of generation and transmission to the marginal units. If they are facing that marginal costs, then they'll be incentivized to do renewable generation to some extent.

The other thing I wanted to throw in is just have transparent billing. I think both the -- your water bill and your electricity bill are kind of hard to figure out so that if there were marginal cost pricing, you might not readily perceive it.

For those graph averse among you, I won't dwell on this, but just to show what peak-load pricing is. You just distinguish two demand curves, the peak demand curve and off-peak demand curve, and charge different prices. For example, in California, Southern California, everybody goes home in the afternoon and turns on air-conditioning, and then it's peak demand, so they have to pay a higher price for that where the off-peak just pays the variable cost.

Now I should mention, this is -- this is good economics, but that's not the end of the story because you need to carefully estimate the demand curve. And the variable cost is a matter of electrical engineering, which is beyond my pay grade. But there's clearly a need for economists to work with engineers and figure out what that variable cost is. There's issues of quality of electricity being different. How do you take these different sources and actually use it in a way to increase reliability instead of decrease reliability?

Another kind of demand management technique is what I called here flex contracts. They used to use in California for refrigerators that you sign up for a program to volunteer, especially in times of high demand and possibly low supply because of generation -- generators are off line or something, then you say, well, it's okay to turn my refrigerator off. Now there's various ways to do this and with various appliances. One way is with a flat rebate. You just get $3 per month if you sign up for this program for a water heater, $5 for -- if you have central air in Mililani, you can sign up for that. It's a little bit uncertain from the consumer point of view.

Another option is to give them proportional rebate at either preset prices, or if you really went the full economic route, you would give them the peak-load prices that actually reflect the -- for example, the generator being off line. You could call it emergency pricing. That would be more attractive for the consumer and incentivize more energy-saving technology and also generate profits that allow the utility to do what we call block pricing. That is, the important thing for incentives is that this second block, that the marginal unit you're buying is equal to the full marginal cost. Now for lower units it's okay to charge less. That won't have any problems for incentives. So this is a convenient way when a utility is generating excess profits without causing a hardship to consumers and still facing them with the full incentives.

We mentioned net metering. There's a couple of interesting features about this. One of them is when you have PV for your house and you choose to stay on the grid, so your meter -- and you elect the option of net metering, your meter runs backwards when you're putting electricity into the system. One kind of limitation of this is if you have, for example, a September 30th ending date for your so-called reconciliation period and you generated a lot of surplus in the summer because of a lot of sunshine and you were careful about the air-conditioner, then you would end up with a surplus that you don't get to bank. So it's a little bit of a disincentive in the system.

And then just to mention the monthly fixed customer charge, from economic point of view should really be the variable costs of things like reading the meter and billing, and this might vary from consumer to consumer. Seven dollars would seem to be reasonable if you lived on Hawai`i Loa ridge, but if you're in Kimberly's apartment with -- where the -- couple of guys can read the meters in five minutes for 15 units, then you're charging $105. It's not clear that's appropriate, especially for low income and middle income.

So I just wanted to end with the economic perspective of Adam Smith, which is, you have to be careful about unfunded mandates even when the -- you're trying to be -- even when you have good intentions. He said, the man of system is enamored with the supposed beauty of his own ideal plan. He seems to imagine that he can arrange the different members of a great society with as much ease as the hand arranges the different pieces upon a chessboard. He does not consider that in the great chessboard of human society, every single piece has a principle of motion of its own altogether different from that which the legislature might choose to impress upon it.

So I think in -- with reference to the initiatives we discussed, the 3185 is largely redundant. And that's actually good news with unfunded mandates because the bad news is you often get unintended consequences and waste and excess taxpayer revenues. I think in the case of 2025, the devil's in the details, and we'll have to see if the task force does an adequate job. If they do, then I think that can be useful legislation. So thank you very much.

THE MODERATOR: Thanks very much, Jim.

And I really want to thank the panelists. We're a minute ahead of schedule here so far. We're going to take that minute and give our court reporter a chance to stand up and stretch, and then we're going to take questions, and Leo and the others are -- Gary's over there collecting the green sheets. And as those of you who know, it's a first come, first served basis. These are the ones that were leftover from last time.

(Whereupon, a brief recess was taken.)

POLICY IMPLICATIONS FOR HAWAII

Question and Answer Session

THE MODERATOR: Okay. Actually, one question for Henry came in before he spoke, so -- somebody got a look at his Power Point, I guess.

We've always thought of the ocean as a carbon sink. Now we're told acidification of the ocean is affecting corals and the life in the ocean. Comments, please?

Henry.

MR. CURTIS: Both the ocean and soil can act as either a sink or a source, and we have to look at the total impact if we are to make meaningful change.

THE MODERATOR: Thanks, Henry.

This is for Jim Roumasset. If good economics have energized the depletion of natural sources, why would current economic theory which excludes life-cycle or energy-efficient models solve any of the environmental problems, solve any environmental problems?

DR. ROUMASSET: Thank you, Tom.

Good economics means what we call looking at the environomy. The economy is embedded in nature. If you look at the full system, then you need to account for the externalities that Henry was mentioning before. And the job of regulation is to make individuals and firms face the true costs of their action, including depleting natural capital and including pollution. So the theory is not a problem. Sometimes measurement is one of the difficulties. That -- there's been a lot of advancement, for example, on the damage costs of global warming. And certainly we've been working on the cost of sulfur for a lot longer. So it is possible to expand a set of incentives to have an efficient system.

THE MODERATOR: Thanks, Jim.

This is for Robbie regarding his remark encouraging using the law to keep the money -- regulations to keep the money here in Hawai`i. If the problem we face is global warming, shouldn't we allow any money raised through regulation -- should we allow it to flow to the areas in our world where the benefits are the most efficient and effective instead of to artificially keep the money here if they're not the best to help solve the problem, the global problem? This sounds like another economist.

MR. ALM: You know, that's a -- that's a legitimate point of view. I think the challenge that a number of us see in Hawai`i is the way our economic structure is anyway, we have a very significant have/have-not problem as it is already. And we're going to, in one form or another, add on to that taxes or -- or permitting costs for -- for carbon, which are gonna raise prices even higher. I think the equation then becomes even more difficult for people who are struggling to survive in the economy as it is. So the notion of trying to ensure that the money flows back in, in both incentives to people to take positive action, but also into the economy in the form of jobs or other kinds of activities here, has other -- has other value.

So, I mean, it's a legitimate choice to say, send it anywhere you want on the planet. I just struggle with the reality of what this state's challenges are in greenhouse gases but also in the way our economy is structured, in the types of jobs we have, in the possibilities for new industries or businesses that are related to doing the right thing by our planet and desiring that that money stay here. So, you know, I understand the other view. I just feel strongly that we have -- we have people to take care of here and that we should make that a priority.

THE MODERATOR: Good. Thanks, Robbie.

This is for either Mina or for Jim. It's a little bit off the subject, but not entirely. Do you support pay-at-the-pump with basic no-fault insurance included in the cost of gasoline? It would be revenue neutral to the commuter and promote fossil-efficient cars with greater use of mass transit. It's basically taking care of the no-fault problem and increasing the cost of gasoline so people drive less.

DR. ROUMASSET: Yeah, I mean, pricing at the pump is one way to -- certainly the -- for pricing carbon, you can -- suppose you have a cap-and-trade system. Then the refiner, let's say, at the refining level or at the wholesaling level, they're going to be paying for those carbon permits which is going to get into the price anyway. So actually, if you had cap-and-trade, it would be more effective to do it at the larger level.

If you have a tax system and you're going after carbon, then taxing at the pump is fine. That doesn't really -- it's not a very effective instrument for congestion because somebody driving at peak time periods is causing a lot more social cost than somebody driving at non-peak periods. So we need probably a different instrument for that one.

THE MODERATOR: Mina, you want to take that one?

REP. MORITA: I think this has something to do -- I was the only legislator that voted against the -- the general excise tax on gasoline bill. I think, you know, pay-at-the-pump serves an important model that we should be looking at in trying to deal with energy policies and environmental issues. So it shouldn't be overlooked, and, you know, I would support looking at pay-at-the-pump as a mechanism to address these kinds of issues.

THE MODERATOR: Thanks, Mina.

Another question for Robbie. If we can find an effective means of carbon sequestration of existing power plants -- and this should probably go to Carlito who's left -- will the PUC allow HECO and the IRC to pass that cost of implementation on to the ratepayers?

MR. ALM: The basic regulatory structure of the state passes on all legitimate costs to ratepayers. So, I mean, that portion of it is probably easier to answer. You know, the work is really being done to figure out ways to capture, to sequester carbon, or to make use of it. You know, the question earlier about whether we can either use ocean sequestration -- the possibilities for land sequestration here in Hawai`i are obviously very different -- you know, we're not sending it into our aquifers -- than on mainland states when they're sending it into salt caverns or other kinds of formations.

But, you know, you're going to hear some about it later today. I mean, you know, one of the possibilities that's really being looked at is the use of that carbon as part of the growth of, say, marine algae; that carbon is -- the CO2 is a growth medium for marine algae. So could you take -- could you capture it off our stack and essentially inject it into a bed of algae and then be able to use the biodiesel that came out of that back into our plant. I would certainly think if that equation was created that the Public Utilities Commission would support our doing it for a whole variety of reasons, I mean, because it would address a lot of the issues we're talking about today but also address a number of others.

THE MODERATOR: Okay. Thanks, Robbie.

This is for Mina Morita. Can Hawai`i get legislation passed to promote rebates to the consumer so that Hawai`i roofs, both residential and commercial, have solar panels for electricity generation to the level achieved in Germany? I don't know what that level is, but --

REP. MORITA: Correct me if I'm wrong, but I think we already authorized the PUC to deal with these kinds of issues. I think the issue of these rebates are better addressed at the regulatory level than the legislative level.

THE MODERATOR: Good. Thanks, Mina.

Another question for any or all: How might a carbon tax affect tourism in Hawai`i, the number of arrivals, length of stay, visitor spending, isle visitation packets? Anybody want to take a shot that one?

MR. CURTIS: First, the carbon tax would not apply to the flight over, which is under federal regulation. It would only apply to what happens within the state. Second, the whole idea is to reduce our use of fossil fuels. If we invent a strategy that maintains our use or increases our use, we're going backwards, or forwards faster to climate change.

MR. ALM: I think at one level the answer would be that -- and I don't disagree with Henry. The issue is you would add on to the cost of products, presumably including jet fuel sold here, whatever cost you wanted to associate with the carbon in that jet fuel, however you did it. You know, it could be passed on at the refinery level, at the cap-and-trade system, or even in a carbon tax. So if you had a jet fuel price increase, will that affect tourism? That's a question for someone else to answer, but that's the essence of -- the question is, the Hawai`i vacation may become more expensive. On the other hand, you know, this is a worldwide issue, and hopefully the taxes or the prices on carbon will rise worldwide, and so hopefully it isn't a marginal decision made there between two places.

THE MODERATOR: Good.

Another question for Robbie. I think he answered this one in his presentation, but is there any hope of Oahu getting -- no, he didn't say this. Is there any hope of Oahu getting a majority of its power from renewable sources in the foreseeable future?

MR. ALM: I think the answer to that is -- is yes. And back to something I said, it's gonna require that a lot of us get on board. There are definitely wind resources on this island. They are on the -- clearly on the North Shore and the Kahuku area and around the corner, and that's -- it's the upper windward side that is at this point our wind resource. There are ocean resources, you know, seawater air. Most of the OTEC proposals we've ever heard of are off Kahe, cabled onto the islands. You know, we'll have -- we'll continue to have this argument, but we do think that we can substitute biodiesel or biofuel crops for petroleum and that that's a plus. Certainly it counts today.

There's significant savings still to be achieved by solar roofing, by energy efficiency. You know, per capita we're the best solar roof state in the United States, and we should feel very proud of that. But the reality is it's still one in four single homes, and it should be half of all single-family and single residence or three-quarters or eventually every home or nearly every home. So there's lots of room to add that to the equation.

You know, so you start to add up the ocean, the wind, the fuel-switching, the garbage-to-energy increases, yes, I think that an awful lot of Oahu can get there, but we're gonna have to say yes. We're gonna have to say yes to those kinds of facilities in our neighborhood. We're gonna have to say yes to -- yes to the look and feel and -- and whatever consequences or however you want to describe the -- the impacts of some of our renewable resources, that we need to be okay with it. We need to say to ourselves, whether or not you think a windmill is the most beautiful thing in the world, it's more beautiful than a barrel of oil.

You know, and we need to find the right equations for ourselves as a community. We do value beauty here. We clearly value natural beauty. We clearly are very aesthetically interested people. We always have been. I think it's spectacular that we have no billboards in Hawai`i. I mean, there's been more attention paid probably in Hawai`i to aesthetics than most places. Having said that, you know, we need to also say to ourselves that our sense of aesthetics needs to incorporate a sense of what the future of the planet is and that things that, you know, we might feel a little uncomfortable with become far different if you -- if you calculate that in.

We had a similar experience to -- to the one that Mina talked about. When we were looking at the wind farm on the west side of Oahu, the strongest proponents for it were the students at Nanakuli High School. And part of the reason they were strong proponents for it is they said, you know, much like what Nina said, is from the future's standpoint, they look just fine to us.

THE MODERATOR: Good. Thanks, Robbie.

Another one for Mina: Why did the legislature allow the redefining of renewable energy to include energy efficiency instead of real renewable energy, which most people interpret as generation from wind, solar, ocean, et cetera? Are there plans to fix the definition?

REP. MORITA: I think, you know, we have to look at -- you know, it's a real balancing act, and nothing is set in stone. But what was realistic to take us out into the future, the near future, as we work on these kinds of issues, definitely there are some really good technology that would fall more on the efficiency side than would fall on the renewable side that we wanted to incorporate. And so, you know, legislation is not set in stone, but this was a good beginning for us to meet the challenges that are unique to Hawai`i.

And again, some of the challenges that are unique to Hawai`i is we have really small grid systems, so, you know, we have to look at that interaction of each island as a -- really almost a separate utility and that uniqueness of the state. You know, these kinds of technological issues might be easier to be solved on the mainland. So, you know, we have to be flexible in -- in crafting the RPS renewable portfolio legislation. But again, it's not like it's set in stone, but this is the first good step for us to get in the right direction.

THE MODERATOR: Thanks, Mina.

Question for Robbie: To encourage conservation, will HECO calculate and print the -- I guess it's the user's carbon footprint, the ratepayer's carbon footprint? If not, why not?

MR. ALM: Well, we -- excuse me. Could you --

THE MODERATOR: I think the question is -- Doc Barrie, correct me if I'm wrong. I think this was asking if HECO would be willing to calculate the carbon footprint of its ratepayers in terms of doing an audit. Is that the question, Doctor?

DR. BARRIE: Printed on the bill.

THE MODERATOR: Oh, printed on the bill.

MR. ALM: We could clearly calculate our CO2 emissions. We do anyway. We can clearly calculate the amount of fuel we use. We can calculate a variety of ways. The legislature asked us, for example, to print on your bill the amount of energy that's renewable versus that which comes from fossil fuel sources, so we do that right now once a year. So yes, we can calculate and put on your bill a variety of things.

It's our intent though to -- based on some experience we've had with the folks in West Oahu to whom we give a series of reports annually at their insistence, to begin to publish a lot more about the numbers on our system. You know, what's the footprint of our -- of our own units? What's the footprint of the IPPs, the independent power producers, because I think we're going to have a number of critical decisions to make as a community in the coming years about various kinds of resources and, you know, what the system looks like. So I think we have to be increasingly transparent in what the impacts of particular parts of the system are.

But I think we're also all joining registries. The State of Hawaii is, has already made that commitment. So facilities are going to increasingly around the country essentially be registered, certainly by their greenhouse gas components. And that's -- that's a good thing. I mean, let's get this information on the table and have it as part of the discussion.

THE MODERATOR: Good. Thanks, Robbie.

This one's for Jim. For CO2 emissions, why can't you regulate all sources through an upstream cap-and-trade policy that controls the distribution of fossil fuels?

DR. ROUMASSET: Cap-and-trade automatically does that. You don't want to have double counting. So if you're doing those sources I mentioned and -- for example, you have -- you have a cap for the refiners and the -- anybody that brings in refined product, so the cap is there. And then you don't want to put it anywhere else. Otherwise that would be double counting just for the fossil fuel. So that's the kind of principle.

THE MODERATOR: Okay. Thanks, Jim.

This one's for Henry. The head of NASA says climate change can be beneficial. Is this the new fossil fuel propaganda?

MR. CURTIS: It certainly sounds that way.

I want to also make one other comment. If you look at only fossil fuel, you do not count, for example, releases from soil when you grow things. A world-famous soil expert said that currently soil could account for one-third of the total amount of CO2 released equivalence as all fossil fuel worldwide. So soil could act as a sink or a source. But if you don't look at other factors besides just the fossil fuel component, you'll get the wrong answer.

THE MODERATOR: Good. Thanks, Henry.

This is a long one. I'm not sure I can read the handwriting. If everything is a top priority -- this is for Robbie. If everything is a top priority, nothing is. If greenhouse gas, slash, climate change is the problem, shouldn't that remain the focus of the regulatory scheme, of regulatory schemes? It's a laudable goal to minimize local economic and consumer benefits by forcing renewables -- forcing revenues from carbon taxes or other regulatory fees to protect local jobs, to address social issues. However, as a global problem with grave local impacts in sea level rising, how can not counting sequestration and climate credits elsewhere be counted -- be encouraged.

MR. ALM: Again, I don't have any problem with the -- the formulation that the question-writer had. I just think we can do better than that. You know, we can do both. We can both help this planet and attend to our people. And I -- I don't see why we should start out with the notion that we should ignore what its impacts are to Hawai`i. You know, maybe -- you know, maybe you wind up there, but why wouldn't you in the attempt to design it see if you can't do two-fer or three-fer or four-fer-one and do both?

THE MODERATOR: Thanks, Robbie.

That's the end of the questions from this particular round. And the logistics of getting people from last round -- since some of them have left, I can't give those to them. But I want to thank -- I want to ask you to help me thank these speakers for both their presentations as well as for the -- as well as for the overhead and the questions. And also I want to thank all the speakers from this morning.

(Whereupon, the luncheon recess was taken from 11:51 a.m. to 1:00 p.m.)

THE MODERATOR: I think we better get started. We have two panels this afternoon. The first one, the first panel this afternoon is Options and Strategies for Controlling Greenhouse Gas Emissions. We have five speakers and a question-and-answer session.

I'd just like to ask the speakers, some of whom couldn't make it this morning -- we have a court recorder here, and we'd ask you to speak slowly and articulate so she can hear it. And then I'd also like to ask folks to try to stay to the 15 minutes because we've got a lot to get through this afternoon.

I hope those of you who saw the movie enjoyed it. I was involved with those folks before they made that, just before they made that movie.

The speakers this afternoon, we have Dave Rezachek with the Hawaii Renewable Energy Association. He's gonna talk about renewable energy. And Brian Kealoha, he's with Energy Industries. His boss is actually active on the forum and chairs one of our committees. Brian's going to talk about energy efficiency. Shanah Trevenna from the Sustainable Saunders program at the University of Hawai`i, she'll be joining us, and she's going to talk about what each of us can do. I think this is sort of a 50-ways-to-save-the-planet presentation. Jeff Mikulina from Sierra Club, who's also been involved with us on the forum, is going to talk about From Belief to Behavior:

Motivating Change, which was something that was talked about a little bit this morning. And then Barry Raleigh is going to talk about Feedstock for the Future, and he's talking about renewable energy and algae.

So with that, David, why don't you go ahead and lead off.

OPTIONS AND STRATEGIES FOR CONTROLLING GHG EMISSIONS

RENEWABLE ENERGY

Dr. Dave Rezachek, Hawaii Renewable Energy Association

DR. REZACHEK: Okay. Good afternoon. I'm filling in this afternoon for Warren Bollmeier who's the president of HREA. I'm actually with Hawai`i -- Honolulu Seawater Air-Conditioning, so you'll see a little slight focus on seawater air-conditioning in this presentation.

Okay. Basically what I want to do is look at renewable energy, what it is, why it's needed, the different types of resources that we have in the state and also on Oahu, the development potential on Oahu as I see it, status of the various conversion technologies, something called learning curve analysis, and then, as Henry mentioned and a couple other speakers, life-cycle energy and greenhouse gas emissions benefits and be looking at a source to end use pathway analysis. And then finally, I'll show a little comparison of the benefits of various renewable energy technologies.

Okay. Well, what is renewable energy? I'm not a big fan of the renewable energy definition in the statute, so I prefer the definition that you see here. It's an energy derived from resources that are regenerative or for all practical purposes cannot be depleted.

And why do we want to use renewable energy? Well, it's abundant, and, as you'll see, it's very diverse. Hawai`i's got a lot of different types of renewable energy resources. It's available locally, which is very important; reduces the need for fossil fuels; and then the topic of this hearing is that it reduces greenhouse gas and other emissions.

These are the types of renewable energy resources that are available in the state: combined biomass and biofuels in one category; geothermal, and a lot of you may not know it, but even Oahu has some geothermal resources, a lower temperature resource, but there is some resource here; hydroelectric, Oahu doesn't have much of this, but there's a small amount; municipal solid waste, Oahu's got a lot of this and a lot of landfill gas; ocean thermal, which consists of both sea water air-conditioning and OTEC, ocean thermal energy conversion; and solar, which is electric, there's two forms of that, electric as a photovoltaic, and then there's thermal, which could either be water heating or some sort of process heat; and then there's wave energy and wind energy.

A number of factors affect the development of global energy anywhere you go. These include resource availability. You have to look at two aspects of that: a spatial characteristic, where is it available; and a temporal characteristic, when it is available. For instance, solar is available all over the state, but it's not available in the same quantities in different areas. There are cloudy areas that have a lot less solar, and there's sunny areas that have a lot more solar. And then temporal, and again, if you look at solar, that's available during the day but not during the night whereas something like ocean thermal energy conversion, which is also a solar technology, is also available 24 hours a day.

So it's very important to look at when that renewable energy resource is available; then resource intensity, and again, I mentioned solar that -- for instance, maybe Hilo you don't have the intensity that you have in the Ewa plane here; and then there's the status of the conversion technology. Some of these technologies are mature, and some are early in the development stage; and then we have to look at cost. What is the current cost of each of these technologies and then what is the future cost? And so I'll get into a little something called learning curve analysis which shows how costs reduce as technology becomes more developed.

We have to look at the status of the conversion technologies. Some of these are in just the research stage right now. They're not that well developed. Some are in the demonstration. I would guess -- characterize wave energy as being in the demonstration stage. There are some small wave power plants throughout the world, some even in the megawatt range, but it's not largely developed, and it's not widespread. And then there are other technologies that are commercially availability; for instance, wind or sea water air-conditioning or solar thermal in the form of solar water heating.

Why do we need to look at learning curves? Well, learning curves or learn-by-doing curves or experience curves provide a means for assessing future potential cost reductions in a particular technology. A technology learning curve defines the present unit cost of a given technology as a function in a cumulative production. And I show an equation there, and that's basically how it's laid out.

This shows some learning curves for typical consumer products. And basically what it shows, that -- for instance, cellular phones or microwave ovens, the initial costs of those technologies was very high. There were very few of them. They had to recapture their development costs. There wasn't a widespread market for them. But as the market developed and as the number of units increased through production and demand, those costs dropped rapidly. You can see a cellular phone in the late eighties was very, very expensive. Then when you get into the late nineties, it's dropped by a couple orders of magnitude in cost.

You can get a similar type of learning curve for renewable energy technologies, and what I've shown here is photovoltaics. Now the difference between the curve I showed just before and this curve is that this curve a log basis. So you can see that instead of a linear scale on the left-hand side, we have a log scale. So back in, say, 1976 the cost of 1 watt of photovoltaics is maybe 70 or 80 dollars a watt. When we get to 2001, it's dropped down to about six or seven dollars. And these costs continue to drop as you -- the efficiency of the technology increases and the demand for the technology and the amount of installed units of that particular technology increase. And as you can see, this curve is a pretty straight line so that there's been continuous increases in costs on PV system for at least the last 30 years and substantial -- and that's because there's much more installed capacity, and a lot of work has been done in manufacturing capabilities, efficiency in the processes, that type of thing.

You can see there's a learning curve here. Basically for photovoltaics, every time you double the amount of installed capacity, you reduce the cost by about 20 to 30 percent. So this shows a grad -- or a continual decrease in cost with increase in the amount that's installed.

Now if you take these learning curves and we look at them, which is the upper set of lines here -- and this shows how, for instance, if you had a residential PV system on Kauai, a 2 kilowatt system, which is a typical size system, right now it might cost you 69 cents per kilowatt hour for that system; but as the technology advances, that cost continually drops until -- like the year 2017, you might be down to 33 cents. At the same time, we're having an increase in utility costs primarily because of the cost of oil. So on Kauai you might have a 31 cents or 30 cents per kilowatt hour cost now, so you can see that the cost of electricity from PV is about twice what it is replacing. So that's not a good economic situation. It doesn't make much sense to do PV unless you can narrow that gap through either tax credits or some other incentive.

But as you see, as we go along and the cost of energy goes up and the cost of the technology goes down, there's a point where they cross over. There's three curves on each of these things, and one is -- the center one is probably the average cost, and the upper one is the higher rate of decrease or the higher rate of increase. And so they cross in the year 2012. The convention here is the years you see on the bottom are the end of the year. So sometime in 2012 to 2015, which is these two intersection points, you'll get grid parity on PV systems, residential PV systems on Kauai, meaning that at that point in time you won't need any subsidies. The cost of electricity will be sufficient to pay for the system.

This shows a similar picture on a small scale utility. This is a 5 megawatt system. And you can see that sometime in the 2012 to 2016 time frame you get grid parity on Oahu. And this assumes that all these things continue at the same level. But it shows that PV has got a great potential, but that potential may be five to ten years down the road. And I'll show you why I think that's important for everybody to use this type of analysis on all renewable technologies.

The reason that is, is we only have a limited amount of money that we can devote to development or incentivize different renewable energy technologies. So what makes the most sense is to put that money into technologies that have the most near-term potential and use some of the money for development of those other technologies but not, for instance, put all of our money into, say, PV or any single technology that may not be ready yet. So you need to lay out a program of where you get the most bang for the buck based on where the technology is and how much you need to incentivize it.

So I kind of laid out a system here that shows the technologies that I believe are mid term, near term, and long term. Solar thermal's already cost effective. Wind is cost effective. Seawater air-conditioning are all cost effective. And biomass in the form of municipal solid waste is cost effective. There may be some possibilities of doing coal firing of biomass with the coal in the current AES power plant. And then biofuels, I'm not sure that they're cost effective, but they're getting a great deal of subsidized -- subsidies.

In the mid term, as I said earlier, wave is really in kind of a pilot or demonstration phase, but in five to ten years it should be in a commercial stage and close to cost effective. So it would be a technology to shoot for in that mid term.

Residential intertied -- utility intertied PV on neighbor islands -- I showed the case of the PV in Kauai -- would be grid parity somewhere in the 2013, 2015 area; commercial scale PV, again, the Oahu example; and then a smaller OTEC plant, ocean thermal energy conversion, 5 to 10 megawatts; in the long term, a 100 megawatt OTEC, perhaps residential utility intertied PV on Oahu or utility scale PV on Oahu.

So what does that mean? It means that if you select the right technologies and you select them at the right time that you can do it in a very cost-effective manner. And this is just one possible layout of potential -- renewable energy potential on Oahu. And I think you can see OTEC is number one because it's a base load power plant, provides 24-hour-a-day electricity; the same as the municipal solid waste; then seawater air-conditioning which has enormous potential for Oahu. My company, Honolulu Seawater, is putting in a 25,000 ton system for downtown Honolulu. We think there's at least four systems on Oahu alone. Then solar thermal, right now there's probably 60 -- 50 -- 60,000 systems on Oahu, 50,000 maybe. You should double that number of systems by 2020. And then the wind, Oahu, we don't have sufficient land to have a really large system. So maybe you can only develop 50 megawatts in the North Shore. Wave, again, because of the time it's gonna take to develop that technology by 2020, we may have 25 megawatts. And then PV, because of the cost now and the time between now and the time that it develops as a grid parity, maybe 20 megawatts. But as you can see, we're able to meet the RPS standard for Oahu just with these technologies by 2020 easily. And this doesn't include some of the other technologies that they include in that, energy efficiency and some of the other nonrenewable type things that are listed as renewables.

As Henry said earlier, in order to see what the impact is of these different technologies, we have to look at a life-cycle analysis, energy and greenhouse gas emissions. We have to look at from-the-cradle-to-the-grave type approach for each of these technologies. And we can do this through pathway analysis. You can determine what the total fossil fuel energy displacement and greenhouse gas emissions reductions of a particular energy system is from the fuel source to the end use.

So we've done this system -- or we've done this analysis with seawater air-conditioning. And what you looked at is you look at crude oil at the source, meaning at the well head. And then you look at the efficiency losses throughout that chain. And, for instance, here we can show the production of that crude oil and the shipping -- or at least the production of the oil. It takes some energy to produce the oil, to pump it out of the ground, whatever. That might be 90 and a half percent efficient. And then you need to ship that to Oahu, and that might be 98 percent efficient. Then you need to refine that into the products that you use, whether it's residual fuel oil or gasoline or whatever it is. And then that would be maybe 90 percent efficient. And then you put that that the power plant, and that has an efficiency of around 32 percent. And then you have electricity at the power plant. And then you have to ship that electricity to end users. And you have transmission and distribution losses, so you have about 88.8 percent that comes to the end user ultimately. So that means for every one unit the end user uses, you have to put in 4.42 units of energy to give him that one unit. So that has to be taken into account when you're determining both the energy benefits and the carbon dioxide emissions benefits.

The other thing that it points out is that if you have an end user that uses, say, photovoltaics on their home or solar water heating system, they actually provide for benefits than you have for a utility powered -- or utility scale wind or some other system because you don't have those transmission and distribution losses. So it's a distributed generation type thing where you avoid the 88.8 percent situation there.

So I've done this analysis, and I've looked at what are the benefits of doing a 100,000 tons of seawater air-conditioning. Well, we could save about 344 million kilowatt hours per year. That's about 4 percent of HECO's output, so reduce fossil fuel energy use by about 4.6 trillion BTUs, which is the equivalent to almost 800,000 barrels per year of imported oil, or oil from the source, and reduced greenhouse gas emission by about 377,000 tons.

Well, that doesn't really mean much to most people, but what is that equivalent to? It's equivalent to about 123 megawatts of utility scale wind energy. As I said earlier, we maybe can do 50 megawatts or maybe 80 megawatts of wind on Oahu. It's also equivalent to about 187 megawatts of utility scale photovoltaics or 87,000 residential PV systems or 60 megawatts of utility scale waste-to-energy. Right now the system we have is 60 megawatts, so it would be equivalent to having another municipal solid waste system on Oahu. And then we could take another equivalency. It's equivalent to taking 62,000 SUVs off the road or buying and using 115,000 Prius HEVs.

And there's been a big push towards doing ethanol, and we took a look at what is the equivalency of ethanol. If we look at corn-based ethanol, which has a relatively small net energy benefit, this production or reduction in energy use is equivalent to 247 million gallons of imported corn-based ethanol. We need about 40 to 45 million to produce 10 percent ethanol. It's also equivalent to about 88 million gallons of local cellulose-based ethanol per year. But what that says is that it's much better to produce that ethanol locally from a cellulose feedstock than it is to make it from corn. So when you're doing your policy determinations, you want to obviously produce this stuff locally and produce it with a maximum efficiency or better efficiency.

And finally, it's equivalent to about 123,000 residential solar water heating systems, which is about 50 percent more than the systems that we have in the state. Each ton of seawater air-conditioning is equivalent to about one solar water heating system.

So basically what you need to do is not just look at a whole variety of renewable energy technologies. You need to look at them in a systematic manner. You need to identify those that have the best potential in the near term, mid term, and long term and divide the money, the limited resources that you have, among those technologies to get the best bang for the buck in the nearest term. And this is one approach, and I hope that this IRP process will use a similar approach to look at the benefits and look at the things that we should be doing over these three time ranges.

THE MODERATOR: Good. Thank you very much. That was excellent.

Okay. Our next speaker is Brian Kealoha, and he's gonna talk about energy efficiency. Brian is with Energy Industries.

ENERGY EFFICIENCY

Mr. Brian Kealoha, Energy Industries

MR. KEALOHA: This court reporter in makes me nervous. I'm half Portuguese, so I naturally talk very fast, so I'll make a conscious effort here to slow down.

Okay. So my presentation today is really to focus on energy efficiency and how energy efficiency can really help reduce the carbon emissions around the planet, and no more so than here in Hawai`i. Because the majority of our generation really being fossil fuel dependent, a kilowatt hour saved has a much larger impact than some of the national average numbers I'm going to be going through today in our presentation.

So before we can get into efficiency, we first have to better understand how buildings use energy and how we use energy as a society. This slide really illustrates how much U.S. commercial buildings across the nation utilize in terms of their percentage of electricity. So you can see here that 72 percent of all electric consumption is really used by commercial buildings. And then again, on the mainland where there's more natural gas, you see 54 percent of that consumption, as well as 38 percent of the carbon dioxide emissions. And that's pretty huge when you look at the fact that the U.S. -- commercial buildings in the U.S. produce more carbon emissions than any other country, their combined emissions in the world, other than China. So the significance of our energy footprint is very large.

Breaking that down a little further, the two pie charts there on your right, you'll see the difference between commercial and residential. And again, these are more national numbers than they are specific to Hawai`i, but you can see the different end uses in terms of how we use our energy. Cooling is one of the largest loads. And then when you're in the commercial sector, the next is lighting, followed by water heating, plug load, refrigeration. On the residential side air-conditioning and heating end up being the highest amount of electrical and gas usage, which results as well in the CO_2 emissions. Lighting and, here in Hawai`i, water heating is a much larger segment of that. On the national average it's a little bit less.

So where with are we going with this? Basically, energy efficiency is the low-hanging fruit. It costs with a third to save the energy than it is to produce it. And it's probably even greater here in Hawai`i with the cost of oil.

So we have this low-hanging fruit. What does that mean in terms of potential? This pie chart really helps illustrate the dramatic effect that emissions can be reduced by pursuing energy efficiency. When you look at all the different renewable energy resources combined, it still does not up to as much as energy efficiency can provide. So it seems very clear that it's low-hanging fruit. There's a lot of potential out there.

The question is then, Why aren't we doing it? Well, we're going to get into that a little bit, but the first thing when we're looking at the hierarchy in terms of what you should pursue, the common industry assumption is you're gonna do efficiency first. And no matter if you're gonna be looking at renewable energy systems, what you want to do is make your building as efficient as possible before you get started. And then, as you can see here, the next piece of the hierarchy is really looking at on-site renewable energy and then switching to cleaner fuels. Again, that comes back it the cost effectiveness, as well as the pure economics for what you want to size your renewable energy systems to be.

The potential, this graph really illustrates where we're gonna be with business as usual utilizing our electricity as we are now without making any changes. But I think what is most significant is that we cannot only stem our growth, but actually reduce the amount of electricity that needs to be produced in this country by simply implementing energy efficiency, whether it be in measures that we can implement in our home or our business or by policies that governments can institute to really promote and push energy efficiency.

So how much does it all cost? That's always the key. Who can tell me how much this cost?

AUDIENCE MEMBER: About a dollar.

MR. KEALOHA: A dollar?

AUDIENCE MEMBER: Yeah.

MR. KEALOHA: What about this?

AUDIENCE MEMBER: Three dollars.

MR. KEALOHA: Three dollars?

AUDIENCE MEMBER: Before the rebates.

MR. KEALOHA: And that's typically how we look at things. But I'll tell you that this actually costs you $102, and this costs you $30. Let me show you how.

When you look at the cost for a year, if you were to burn both of these lamps for one year -- sure, I went on the high side. I said $6, and I went 50 cents to even make this analysis more conservative. But you can see that even though see the initial cost is significantly greater, over time when you're using the amount of kilowatt hours that you're using to power both of these lamps, your actual cost and replacement cost as well as energy, is very significant.

And that's pretty much one of the biggest barriers to achieving greater energy efficiency. Most businesses and consumers are first cost driven, so we're looking at ways to value engineer systems to take out the initial costs of buildings. However, that is probably the worst thing that you can do because over the long term you're costing your facility a lot of extra money. In addition, it's requiring a lot more generation that's going to be required to be produced on this island. Couple that with the amount of emissions that's produced. In addition, initial capital outlay can be tough to come up with. You know, if you're going to the store, you have ten dollars in your pocket, and you need to by ten light bulbs, you're probably gonna buy these. So it's very tough sometimes to come up with the initial capital outlay even if you know it's a no-brainer to move forward.

Another challenge is there's a lot of products out there that don't live up to the hype. Being that energy costs are so high right now, there's a lot of different things and technologies out there that claim to be able to do a lot of things. As a result, there are people who are buying into some of the hype that's out there. It really can dampen a market because people have been burned. They don't see the savings on the bill that they expected.

But once again, a case in point is when the CFLs first came out, compact fluorescents first came out. When they first came out it was really a challenge because there was a lot of low quality product out there. And I'm sure a lot of you remember that when the first generation of these CFLs, they would blink on six or seven times. My wife hated it. She said, Get those lamps out of our house. But along the way technology has advanced, and the product has become better. And as result, people who may have been burned by that first situation of CFL that didn't work so well may be reluctant to purchase efficient products as they go forward.

And lastly, as we all know, it's really expensive to live here in Hawai`i. The cost of products, to have them shipped out there, is expensive. And probably more importantly, the availability is sometimes difficult. If a piece of equipment fails, what happens? You need to replace that right away. Well, if the efficient equipment isn't stocked here locally, the less efficient equipment gets put in.

So what can be done to facilitate more energy efficiency here in Hawai`i? Well, of course, education. I mean, that's the first step, the fact that we're all here today to hear about what we can do to reduce carbon emissions. It starts, number one, with efficiency. The second is really looking for state tax credits and state incentives to help promote energy efficiency in addition to renewable energy. You saw the pie chart. The significance of what energy efficiency can be in terms of reducing carbon emissions is large. Federal tax deductions are available, but we have nothing on a state level in terms of energy efficient credits.

We talked about here a little bit the initial first cost, and a lot of times that's a big barrier for people or companies to move forward with projects, so finding ways to finance these energy efficient upgrades and bringing them at zero or low interest through either DSM funds or through a special purpose revenue bond. There's ways to help facilitate the implementation of these measures.

And, you know, a lot of the state agencies capture the benefit of energy efficiency products. A lot of the different departments here have an electrical budget, but they're not going to be real aggressive in pursuing electrical efficiency because they're afraid that once they've made those reductions, their electrical budget in the following year is gonna be reduced, so they don't see the benefits of it, and they don't get to keep the rebates that are associated with these projects. So we need to have incentives in place to really push and promote all of our state agencies to be aggressive in energy efficiency. And one of the first steps was pursuing the in all new buildings the LEED silver is requirement, and that's a good first step because energy is a component of LEED, and LEED encompasses a lot of other things. But we're getting there on the new building side. We need to really look at policies that can be done on an existing building side.

So what can you do when you go home today? Probably the most significant thing is if you don't have a solar water heater, go do it. Now there's never been a better time. There's state tax credits available, federal tax credits available, large rebates from HECO. There's new programs coming out to do the pay-as-you-you-save so you don't have to -- the payments mark your savings. There really hasn't been a better time to do it. So if you haven't doing this already, you should be doing it.

The second is what we talked about already: compact fluorescent lamps, $100 versus the $30, huge difference, not to mention the lamp life over the course of 10,000 hours versus 1,000 hours for incandescents. And if you're air-conditioning your home, there's a lot less heat than that's generated from incandescents, so that reduces the amount of electricity that needed to be generated.

Probably number three is just the use of Energy Star appliances. I think you've all seen these labels on different appliances or even on buildings. But when you're looking to replace appliances, look for the Energy Star logo. Naturally, these are all measures that you can -- that you need to invest in. But I think as a whole, behaviorally, there's obviously a lot of things you can do, those are the no-brainers: turning off the lights when you're not in a room, all the simple things that are easy to do that we often forget just out of ease. Using fans instead of air-conditioning, there's a lot of simple things our behaviors can modify as well.

On the commercial side, you know, the game plan really it's being aggressive in finding energy savings is to do commissioning and studies. There's a lot of buildings with great energy efficient technologies already employed, but over the years the program and the logic behind them have changed or things have been changed in terms of how the buildings operate; and therefore, the systems aren't maximized towards efficiency. So recommissioning buildings, looking at studies, finding ways to reduce energy usage through the different end uses that are in the building. And that's really what's outlined here. You know, lighting retrofitting, it's a no-brainer. It's a low-hanging fruit. Energy management systems to use only what you need to use, drives, motors, pumps, air-conditioning, it goes on and on. And similarly, these are just some other examples that you can look for in your commercial building.

I want to close with, you know, really the most expensive thing we can do is nothing. And expensive can mean whether it be dollars, the amount of energy that we're -- dollars we're spending in terms of energy. It can be in the amount of carbon emissions that we're producing. By doing nothing and continuing down the path we're going now is not a road that I think any of us wants to go down, and efficiency can be a big portion of what we do first. We really are all responsible for the solutions out there. And that's my presentation.

THE MODERATOR: Great presentation, Brian. Thanks.

Our third speaker is Shanah Trevenna from the Sustainability Saunders program on the UH Manoa campus. Shanah.

WHAT EACH OF US CAN DO

Ms. Shanah Trevenna, Sustainable Saunders

MS. TREVENNA: Well, I'm Italian, so I'm going to speak quickly and talk with my hands, so I hope that works with you.

THE MODERATOR: She's got to be able to write it down.

MS. TREVENNA: Okay. I'll do my best to be clear.

First of all, I just wanted to say it's an honor to be up here. It's my first panel. And there's a lot of people on this panel and in the room who've been working for years, if not decades, just to bring us to the point of even having this conversation in Hawai`i. So thank you so much for the work that you've done to pave the way for this.

We've been talking a lot today about the big picture, and I just wanted to propose for a moment think back to maybe the beginning of your day with your morning routine and what you're doing this weekend just to get back in touch with your life here, individual flow of your day, and that's because I'm going to be talking about what each of us can do, individual actions we can take to add up to a collective difference.

Now I also want to ask you to take any thoughts or images or conversations that you've had that have maybe formed a belief that sustainable is sacrifice and just suspend that belief for a moment. And then I'd like to propose that sustainability could be perceived as simplicity and streamlining your life so that you have more time and money and energy to do the things you love, connect with yourself, each other, and the world that we live in, the land, and also any feelings that you have of being overwhelmed. There's been a lot said today. There's lots of different choices and -- bound to happen.

There's a way of approaching this that I've developed for myself that I call the six-pack, the sustainability six-pack, picking six things that you can work on. And the reason I picked six is because people can actually look at six items and see six. They can look and see three. They can look and see five. Once it's beyond six, they have to start counting. So six just seems to be a manageable scope for people.

And I'd like to break that even further into a bit of pyramid: three things that you can do and choices in your own life; two things that -- sorry, I just have to look here -- two ways to interconnect your community, and that's kind of a different angle that I'll get into in a moment; and the third is to support one renewable energy of your choice. If you do those six things, you'll be connected to yourself, the middle picture, and the big picture in a way that's really manageable.

So I'm gonna go through a bit of a smorgasbord. And just go by what jumps out at you, what feels like a pull and not a push. That's another philosophy we use at the university. If it's a push, it feels like sacrifice. It feels like a lot of hard work, and you get resentful, and you don't keep up the steam to keep it going. If it feels like a pull, then you feel excited. You feel like that's a really cool idea. It'll save me a lot of money. So see what feels like a pull to you. And there's enough of us that if we all do different things, it will add up.

So first, I'm gonna start with personal choices. Try to pick three that jump out at you. The first is to -- the first section is to lead a non-disposable life. And we know that we're, you know, sort of a throw-away society. Things come into our world. We dispose of it. It all goes in a landfill. But a really interesting thing about Hawai`i is anything that we use to replace it, we're pulling in. We're actually shipping here. It's taking a lot of fossil fuels to get here. So, for example, I went to one juice joint on the island. I asked them how many cups they go through. They go through a thousand --

(Discussion off the record.)

MS. TREVENNA: So I'm just going to continue then.

So I was saying, juice joints in Hawai`i, one of them uses a thousand 24-ounce cups a day. I can see how a thousand 24-ounce cups would be a lot to capture. So by making a choice of bringing a cup, bringing a plate, bringing utensils, you're making an impact right there. In Beijing they're banning one-time-use chopsticks, for example. It's happening in other parts of the world. In Canada there's 750 million cell phones in landfill. So if you're like me and you only know that you have a 3.1 megapixel phone only when you hit the wrong button, it annoys you, in a couple years when my contract comes up and they want to give me a 7 megapixel phone, I probably will pass it. And so that's a really easy one for me. It's like falling off a log, simple.

So another section is how you move yourself around. And obviously if we could bike and if we could walk, there would be a lot less carbon emissions. Most -- 50 percent of trips are made within three miles of your home, so if you just make an agreement with yourself to do a walk or a bike ride for those threes miles, you'd -- we'd get rid of 50 percent of our trips.

If you idle, if you're going to be idling for more than 30 seconds, it's worth it to turn your car off. That gets over the idea that, you know, it takes a lot of energy to start it up again.

And this is an interesting one. Intense braking and starting wastes a lot of energy, that, you know, rush to get where you're going. They've actually measured that it's only 4 percent of your time that gets shaved off, and it actually uses 40 percent more fuel. Fifty percent of the gas used in the city is used for accelerating. That's an interesting one. And, of course, all that's lost in braking, which brings me to hybrids, which are just the coolest thing. All -- most of that energy in the braking is returned to the battery, so it's captured again. With the new solar roofs that have come out for hybrids, they're at 125 miles per gallon.

And if you use your air-conditioning on a hot day in your car, then you're using an extra 10 percent as well.

If you keep the air in your tires, your air filter change, and you use the right oil, 20 percent better gas mileage as well. So there's a few things you can do.

In your home -- I know for Saunders -- and we saw some different stats -- 80 percent of the electricity use is for air-conditioning and lighting. Yet when we do focus groups with people, they said that they -- like the thing that they would like the most is natural ventilation and natural lighting.

So I'd like to start with ventilation, the opposing window idea. When you open up the driver's side and the passenger's side, it's way better crosswind. You can do that in your house with a fan facing outwards. It can suction the air across. And I won't get into the mechanics of fans, but if you have two fans going at 50 percent the power, that actually uses less energy than one fan going at 100 percent of the power. So you can use different fans and use less energy. A lot of people don't know about that.

And then jumping to daylighting, so daylighting is a great thing because students that use daylighting have 20 to 25 percent higher test scores. And also our eyes are not adapted to go from isolated light to no light at all. So uniform light in a room is very important for the human experience. So to bring daylighting in, the biggest bang for your buck is a light shelf. It's kind of like a visor for your window. It just above the sight line. It divides the window into two halves. The top part has the light reflect off and come to the -- into the room, bouncing off the ceiling. Painting the ceiling with a highly reflective paint will then diffuse the light down into the room, and the wall that's opposite of the lighting as well.

Interior rooms, you can bring lighting in by knocking out part of the wall if possible or putting glass, a glass window. They also have solar collectors that take --

THE MODERATOR: Shanah, slow down.

MS. TREVENNA: -- oh, thanks, yeah -- that take fiber optics, and the sunlight comes through the fiber optics into the center of the room. So you can actually kind of pipe in sunlight.

So if you do have lights -- I won't get too much into this 'cause we covered that replacing an incandescent with CFL is definitely the way to go. In Canada they're banning incandescent lights all over the place. So that's a whole country that's moving towards absolutely banning incandescents, completely having none.

If you do have fluorescent lights, you can do -- you can drop the whole ballast down about 18 inches, cover the bottom, and have all the light reflect up to the ceiling. And then that light will then diffuse down into the room, creating that whole uniform lighting I was speaking of. That actually saves about 75 percent of the energy. It goes from needing 2 watts per square foot down to .7 watts per square foot. So then if you can find three things in there, I hope three things jumped out at you.

And then interconnecting with your community is a big one. And this is why in Denmark businesses that were neighbors got together and wrote down all the inputs and all the outputs that were coming into the businesses. And one found that they were paying for a chemical to be imported from Spain while the company next door was paying for that exact same chemical to be disposed of. So they were able to just make that match, save a lot of importing and exporting, and everyone made a lot more money.

In British Columbia -- this is a little stray -- a pig farmer went to a neighborhood theater and said, Can we use your extra popcorn to feed the pigs? No problem, except that the pig farmer, organic farmer, so they needed organic popcorn. So then the theater owner went to a corn producer, asked them if they would make organic corn. They went to the bank and said, I have a guaranteed market; can you give me a loan to go organic? So all these win-win-win situations when you know your neighbor.

And we know this in personal experience, I'm sure. If you drive across town to drop off your kids at daycare, to go to the yoga class or take a cooking class, if you know your neighbors, you might find out that people right in your community could do all of those things for you. So that -- that really helps to grow a local economy as well.

For a thriving community economy, a dollar should pass between all the people in the community five times before it leaves. They know this in Salt Spring Island off of the coast of British Columbia where they have Salt Spring dollars where you actually buy the dollars, and you can only pay -- use them in Salt Spring. Tourists come in and take those, and that money stays in Salt Spring. So there's an island which created a local economy with local currency, which would be an opportunity here, I think, as well. So then the -- and so if you could find two ways to do that.

And then the third would be to support your favorite renewable energy of choice. We've gone -- I won't go through them all since they've already been covered beautifully. But my favorite is ocean wave given that there's -- it's 800 times the density of air, water. And I've stood in the wind, and I've stood in the waves, and one really pushes me over harder. I feel like there's a lot of energy there that's waiting to be harnessed in a way that's not intrusive to the coastline. So with great minds working together, I feel like that could be the energy that fuels the future.

So with making three choices in your personal life, two new ways of interconnecting your community, and supporting one renewable energy, you'll feel great; you'll have more money, more time, more energy for yourself and your community; and I believe you'll also be part of a very important, very big positive movement. Thank you.

THE MODERATOR: Thanks, Shanah. Sorry for insisting on the breaks going on.

Our next speaker is Jeff Mikulina. Jeff's with the Sierra Club, and he's been very active in the Energy Policy Forum. Jeff's gonna talk to us about Motivating Change, From Belief to Behavior. Jeff.

FROM BELIEF TO BEHAVIOR: MOTIVATING CHANGE

Mr. Jeff Mikulina, Sierra Club

MR. MIKULINA: Thanks, Mike. How's this? All right.

I really appreciate this opportunity to talk about this fun subject. There won't be any math involved in my presentation, fortunately, on Friday afternoon here.

I heard an ad the other day on the radio that I thought was absolutely terrible. It was trying to motivate behavior change on another very serious subject, drunk driving. You may have heard this ad on the radio. It's brought to you by the Department of Transportation. Three things stood out of why it was so bad. It started by having some kind of upbeat music in the background, and an announcer who sounded like he just finished a spot for a used car lot said, if you drink and drive, you may get in an accident or cause some harm or something. And the spot ended with him saying, Don't let drunk driving happen to you.

The three things that stood out, number one, just delivering that information without any sort of strong emotional pull really made it ineffective. Secondly, that ending piece saying don't let drunk driving happen to you removed you from the equation. It was something that, oh, it happened again. How did it happen? It wasn't a decision you made with clear consequences. And finally, the third, those consequences weren't very clear. We know drunk driving, you can kill yourselves. You can kill someone you love. And if you want to change behavior, we have to make that very clear that that could result from your decision.

Those are the three areas that I want to explore today relating to climate change. The first is this idea that knowledge is everything. We're smarter than we ever have been on this issue, but it hasn't seemed to be motivating behavior nearly as much as we'd like. Nobody marched on Washington because of a pie chart. We really have to evoke those emotional responses in people if we want -- if we expect to have them make those big changes in their lives. The second one, one which we talked quite a bit about today is the idea of barriers. It's not easy being green, and there are a lot of barriers to doing the right thing when it comes to moving to higher efficiency or renewable energy or changing life-style and behavior. And finally, I want to talk a bit about those sequences and how do we pay the price, the right price, the accurate price. We're human. We respond to pain and pleasure. We're animals in that way, and we shouldn't lose sight of that when looking for solutions to motivating behavior.

The first idea of this, knowledge is power. Let's take a look at a recent Gallup Poll in April of Americans. Sixty percent of Americans believe that global warming has begun to affect the climate. So we made quite a bit of progress on this issue, and certainly over the past year there's been -- we see change in how folks view climate change. People are more aware of this than ever. This number actually increased about 8 percent over the prior year. Sixty-two percent believe that climate change will cause major or extreme changes in climate during the next 50 years. So folks are, again, aware of the problem. They know it's happening.

Now 20 percent of those questioned said they either use renewable energy or they're participating in green pricing programs. So folks are claiming they want to be perceived as doing the right thing at this time. The fact of the matter is fewer than 4 percent actually participate. So although that knowledge is there, folks aren't really responding in their day-to-day lives, at least at this level in doing energy sorts of things.

Since we're talking about Americans, a poll at the same time, a Roper Poll, actually showed that 17 percent believe in alien abductions. This is a point reference for America.

This chart is terribly important. It talks about -- it shows the acidification that's occurring in the ocean that's going to probably change things in Hawai`i like the reefs or the basis of our marine food chain, but it doesn't inspire a lot of emotion. Similarly with this, this is a fairly dry thing, nothing to argue here. This is what's happening on the ground globally, but it doesn't inspire the same sort of heart-string emotion as maybe this image does, the actual effects of a warming globe. Or this one, penguin party barge, but these guys are actually in bad shape.

Similarly, a fact here from National Oceanic and Atmospheric Administration, as the water temperature increases from a warmer globe, the wind velocity increases, and storm moisture content increases. We know warmer water means stronger hurricanes now, but that doesn't nearly inspire the same emotion as looking at Hurricane Katrina come across the warm waters in the gulf and turn into that new storm that struck two years ago. This was an event that definitely shook the American people and invoked that sort of emotion. It wasn't the chart. It was seeing these sorts of pictures of what actually happened in New Orleans, again, about two years ago. This is what can motivate behavior, when people see the consequences emotionally of action.

Talk about barriers now, things that get in the way of us doing the right thing. Once you have that knowledge, you feel emotionally drawn. You want to do the right thing. And all of a sudden you find out you want to go one direction but you just can't. There are barriers in place. It could be as simple as cost, economics. It could be habit. There are a lot of things that make it difficult to do the right thing, move from -- we heard from Brian -- from incandescents to compact fluorescents, or to get someone out of this and put them into this. Or better yet, have them carpool. Or even better, put them on the bus. Or the best, get them on a bike. Of course, there are a lot of hurdles and barriers to doing so. Biking, maybe the lack of bike lanes in this town is probably one of the biggest barriers. I know for me personally, if I have a meeting, I think about am I gonna be sweaty? What am I gonna do? You have to think of a lot if you're gonna ride your bike that day, how far you have to go, what's the weather doing. So there are barriers.

Similarly, we want to convert this roof to this roof or, even better, this roof. There's a huge cost hurdle involved there. So there are barriers to doing the right thing even if people have the knowledge and feel emotionally pulled.

Some of the barriers are pretty stupid. We have some homeowner associations that prevent the use of clotheslines, something that saves a bunch of money, a bunch of CO2 if folks can get in the habit of using a clothesline on sunny days instead of a dryer. Some of them, people are just lazy. We have to acknowledge that. If it's not your job, it's not your job.

Speaking of being lazy, this brings up a great example with our garbage situation on this island. We know we have a solid waste crisis. We don't seem to be very good at responding to it. The vast majority of waste components on this island can be recycled or composted or dealt with besides a landfill or incinerator, but we recycle very little of it. It's no surprise though when the City comes to your house not once, but twice a week to pick up your trash. So think about those two choices. Do you recycle, or do you just throw it away? Well, you know if you throw it away, you can just take it to the curb and they'll deal with it. If you want to recycle though, you actually have to get in your car, find a high school, go to a redemption center, a lot of things in the way of doing the right thing as opposed to doing the not sustainable thing. However, if you turn one of those weeks -- one of those pickups into curbside recycling, it will really lower that barrier for folks doing the right thing. You can take your pickle jars and newspapers to the curb and they pick them up.

This is critically important because in the past seven years, believe it or not, per capita waste production on this island has increased 26 percent, which is from the most recent study that the City commissioned. Despite all this reduce, reuse, recycle, despite the best intentions, we're getting worse and worse at dealing with our trash and our trash production, yet still no curbside program for this island. It's unclear when we'll get it. So that's one of the barriers.

Getting back to climate change, another barrier to taking action is this idea that we have an effect on what's happening. The social scientist Helen Ingram said if we want people to respond to a problem, we need to have three ingredients. The first is the problem and the impact of the problem has to occur soon. It has to be something that's going to occur in the near term. Second, the issue has to be salient to the person. And finally, it has to be certain. So we have to be clear that this is what's gonna result from this action.

The thing about global climate change, why some like James Hansen calls it the public policy from hell is because it doesn't have these three ingredients right now. It's unclear when the impacts are really going to occur. How much can I really impact it? How salient is it to me? What is the impact? And isn't there still some uncertainty about exactly what's gonna happen? It makes it very difficult for us, for community members, for policymakers to do the right thing. If your house is on fire, you know how you're gonna respond. We don't have that sort of urgency right now with global climate change.

Public opinion polls show that people believe that global climate change is confusing. They don't see how it relates to them in a day-to-day way. It won't affect them personally, most people believe. It's a problem for the future, not now. And finally, probably a bigger one, is they can't -- they can't really be affective by their individual actions because the problem is just so big. As Al Gore says, folks often move from despair to denial without stopping in the middle and actually taking action that's effective. This is a barrier to taking action, all of these things where folks particularly feel as though their actions don't have the effectiveness they would like. It's just a drop in the bucket. It's not going to make a difference.

Current attitudes towards this issue, people are unclear on climate change, the causes or solutions. So that is somewhat of an information problem. We have to cut through the clutter and get the right information out. People don't think it will affect them personally. The issue is pretty negative and depressing, and because of it, people don't include climate change in the -- as an important issue in making the day-to-day decisions, which is handy for humans to basically ignore the problem.

This is where we'd like to be though, the ideal attitudes where folks understand climate change and its causes. They see the impact it may have in their lives and their kids lives, and you feel empowered to take action and finally integrate that into your daily decision-making. This is the challenge that we have.

There's some strategies to do this, and there's a whole host of literature on human psychology behind getting people to change their behavior in this way, but some of them -- real briefly, one is this idea of prompts where you're constantly reminding people of the issue and the solution because, as we all know, out of sight, out of mind. Making public commitments or commitments that are visible to others, people are much more likely to follow up on and respond to because all of us want to be viewed as someone who follows through with what they say and that they're consistent that way. And the most powerful probably is the idea of normative social pressure or peer pressure where we respond to how others around us are behaving. I like to call this conspicuous conservationism, folks that are visibly outward in a conservation behavior as a way of kind of gaining acceptance. There's a group, a local group called Kanui Hawai`i who's trying to invoke some of these strategies in making change. I encourage you to check them out.

Finally, consequences, and this is do our actions have clear consequences? With global climate change it's so difficult because the consequence might be something that occurs a hundred years from now; it might not. It's really unclear. Certain behaviors, if you make it clear what the consequence is, people will respond.

Another solid waste example really quick, three years ago we recycled about 25 percent of our bottles and cans in this state. As soon as we tacked a nickel on to each of those containers, the recycling rate, incredibly, over three or four short months tripled. Just a small change made a big difference in that case. Now we've recycled about a billion bottles and cans since it took effect in January of 2005. This chart is actually a little bit dated. It's dropped down a little bit, but nonetheless, we've still pretty much tripled the recycling rate due to the bottle laws.

It's not unique to Hawai`i. This happens all over. This is a graph showing the redemption rates, basically the return rates at different levels of deposit. About 20 percent with no deposit, that's just a background volunteer recycling rate; 70 to 80 percent for a five cent deposit. Michigan has a ten cent deposit. Their return is about 90 percent. And if you go to Germany, you'll be paying a quarter Euro on bottles and cans. They recycle at 99.8 percent of bottles and cans. So people respond to this economic driver even if it's small change like a nickel on a soda bottle.

You're already paying the price for our actions involving global climate change. You know what gas costs now. But is it enough to really change behavior like we'd like to see behavior changed? People are taking action.

We're seeing some major players pushing some of the these solutions to save people money. Like Wal-Mart's selling compact fluorescents. But is it really enough to get us where we need to be?

One solution to address the future cost of climate change is to have a carbon tax, and this is something that has been batted around. I think New Zealand has passed one. Boulder Colorado has one. But it's a way to kind of capture those future costs of climate change today and help inspire people to make the right decisions. It's something that people kind of first looked at the idea of a tax. You can also view it the other way as making it easy to do the right things because whatever we collect on the carbon side, we help subsidize the sustainability sorts of measures, efficiency, sequestration, things like that.

Just a real world example would be the idea of a rebate. California's currently debating such a measure. We had a discussion in this building a number of times where Hummers pay for hybrids. A heavier, more expensive, less efficient vehicle would have a small tax on it, and that would be applied to a rebate for a more efficient vehicle, just a way, again, of trying to shift behavior through economic consequence. And we think things like this make sense, just the example of people making sure we pay a full price and change behavior that way. That is, ultimately, if people don't respond to the emotional pull, to the other ways, if you hit them in the pocketbook, people will change behavior.

So just to summarize those kind of three ideas, again, back to that radio ad that was so disturbing -- it's still running. You might have a chance to hear it. It does nothing to change behavior because knowledge alone isn't power. It really needs to have an emotional component. Feelings buttressed by facts work far better.

We have to eliminate barriers to doing the right thing. And that's really a role for policy and for everyday behavior change. One of those barriers is this perception that you cannot change the problem. And that's going to be the biggest issue that I think we'll have to tackle with global climate change. Each of us is -- can make a difference. Global climate change doesn't happen to us. It's something that we can actually affect.

And finally, making saving the planet saving money. And that might require new tools with a carbon tax, shift behavior, hitting people in the pocketbook. But let's all remember what Winston Churchill said: People and nations behave wisely once they've exhausted all other alternatives. Bear this in mind when moving forward. Thanks.

THE MODERATOR: That last one was inspiring, Jeff.

Thanks.

Our final speaker before the Q & A is going to be Dr. Barry Raleigh with the University of Hawai`i. Barry came here to become Dean of the School of Ocean and Earth Sciences and Technology, and now he's a recovering dean back in research mode and also doing some pretty exciting things. Barry.

FEEDSTOCK FOR THE FUTURE

Dr. Barry Raleigh, University of Hawaii

DR. RALEIGH: Yes, excuse me. Thank you.

The elephant that's in the room that nobody has quite talked about even in our discussions of policy is that the world has, according to all the scientists in the earth sciences that I know who can claim some knowledge about the oil resources of the world believe that there's a peak now occurring in the actual global production of oil, that we will not see a rise in the future again of the total annual production of oil. That's a -- that's an alarming fact if it's true. Personally, I believe that it is. But if it is true, the other side of the room has another elephant in it, and that is the fact that the population of the world is not leveling off. It's going up. And the demand for petroleum will increase probably something in the neighborhood of 3 percent a year.

So what do we do? Well, most energy uses actually don't require oil. There are ways to get around the problem. Conservation is the most obvious, of course. Don't use as much. But on the other hand, there's coal. There's nuclear power. However, if you're interested in getting from here to there on wheels, you need oil. You need something that's liquid that has high energy density, easily transportable, and there aren't many substitutes yet for that. Hydrogen certainly is not one of them.

By the year 2030, according to Royal Dutch Shell, the demand for petroleum will exceed the supply by 10 billion barrels per year. The current global production is only a little over 30 billion barrels a year. This represents an increase in demand above what we believe to be the peak level of supply by about a 30 percent level.

Chevron Oil Company makes some predictions about how we're going to accommodate between 2005 and about 2030 the extra demand. Shale oil, believe it or not, that terrible idea back in the eighties to actually dig up Colorado and extract the oil from the shale is even listed here. There's biofuels which constitutes in their estimate probably in the neighborhood of about 5 million barrels a day, which is a substantial. That's the order of about 2 billion barrels a year. Gas to liquids, that's where you take natural gas and make liquid fuels out of it. It's a very expensive process, but there's a lot of gas around. It's a good idea. Extra heavy oil and bitumen, that really means the tar sand that you all have read about somewhere, I'm sure, in Athabasca and also Venezuela. The problem -- and the problem is that that's really the easiest to get at and the most expensive in terms of carbon dioxide production to extract. It takes -- it takes three barrels of oil mined to get one barrel that you can actually take to market and sell. And that extra oil is used in burning, in effect, to make the heat to extract the tar. It is not -- it's not a nice solution.

By 2025, 2 billion barrels a year will come from tar sand. That will be 2 billion tons per year more of carbon dioxide in the atmosphere unless there's found a way to extract it, strip it, and store it. The gas to liquid plants will yield about 700 million barrels a year. That would be about 250 million tons more per year of carbon dioxide. And to compare it with something, all the U.S. coal-fired plants right now currently produce 2 billion tons per year of carbon dioxide. So we're not looking at a decreasing supply of carbon dioxide. If anybody wants it, there's gonna be plenty of it.

The world consumption by region of coal -- and this is a problem that puts everything else in the shade. The expectations by the International Energy Agency are that the total consumption of coal between 2003 and about 25 years later or so, 2030, will -- globally will increase by 5 -- almost 5 billion tons per year. That -- the fact is that coal -- a ton of coal makes about three and a half tons of carbon dioxide, so you can do the math yourself. That's almost doubling the carbon dioxide. Well, it's another 60 percent of increase in carbon dioxide over that that goes into the atmosphere today.

The -- well, I said that already.

What do you do about it? Well, there's sequestration. Strip it out of the stack and then pipe it over somewhere or somehow transport the carbon dioxide from the power plant to a deep well where it's injected into a saline aquifer and then monitored to make sure it doesn't come sneaking and bubbling back out somewhere. That process costs somewhere between 30 to 60 dollars per ton of carbon dioxide sequestered. So you can imagine if you're -- if you're going to try simply to accommodate this extra 18 billion tons per year of CO2 at a cost of -- call it $40 a ton -- that's an enormous amount of money. And the question is can we afford the electricity that that increase in cost would -- would provide us with? So there's -- people suggested deep ocean, put it in coal mines.

And then, of course, there's biology. And you've all heard, you know, the guy who owns Virgin Airlines, Richard Branson. He's offered a 25 million dollar prize if you can figure out how to strip a billion tons of carbon dioxide out of the atmosphere. Well, I have a solution, very easy, called photosynthesis. And if you just simply plant the state of South Dakota in switchgrass for a year, that will take a billion tons out of the atmosphere. But remember, that's 3 percent of the total we put in the atmosphere every year. So it's a good idea. It's not likely to happen very soon, unfortunately.

How about trees? This comes under the heading of one of those really happy solutions to a problem. Trees take carbon dioxide out of the atmosphere. They make wood out of it, and later you can cut the tree down and burn the wood and start all over again. It's a wonderful thing to do. So just how many trees will it take? And sort of the bottom line is that to get to the point in 2030 when we've increased this burning coal by 5 billion tons a year, we will have had to plant 13,000 trees per second starting now every second, day and night, of the year for 25 years just to stay even. And, you know, that's -- that's a lot of trees, and it would take about four times the land area of the United States to accommodate those trees. It's a great solution, but it's not gonna do it for us.

Then, of course, biomass fuels, we all talked a lot of about ethanol. We've read about it. Frankly, there's an ethical question about using good agricultural land and fresh water to grow fuel to put in your SUV. But there are -- there are ways to make ethanol from waste biomass products, from waste paper, sugar cane bagasse. It's expensive, but it's -- it will get better. We will be able to use ethanol at least for a fraction of our transportation fuel needs. How much? Maybe 10 to 20 percent, I would hope. But I don't think it's gonna be much more than that just from the waste biomass technology. Anyway, go on with that.

Biodiesel I currently like very much. And when I resigned from being dean and I spent a year trying to figure out what we were gonna do about energy, ethanol had a number of problems. One was relatively low energy density. And biodiesel looked good. But it's -- it confronts many of the same problems that ethanol does. Mainly, you don't want to plant a lot of good agricultural land, like we're doing with corn to make ethanol now, which is kind of a scandal, in -- in something that makes fuel. It's not a great idea. Population's growing. We don't want people starving to death because of our greed for filling our SUVs.

The best plant in the land, actually, is an oil palm.

It's a lot better than seed crops. But even for the oil palm, the best land plant, it would take all of Oahu and Kauai covered in oil palm to provide our ground transportation fuel in Hawai`i alone. So it may make a difference, but it's ecologically not a great idea.

I'm going to skip through this fairly quickly because my time is running short.

But the point about algae is they're kind of the Holy Grail of the biodiesel world simply because algae reproduce so fast and produce so much biomass in such a short time compared to land plants and that if you can find a way to grow them rapidly, you can extract the oil, which is about 30 percent by weight, and you actually you can use the rest of the biomass remaining for energy production by making biogas. And so -- so the actual net energy after you put all of the costs of planting and -- planting and building and doing all the work or operations you need, the relative net energy for biodiesel from algae, if you include the biogas produced from the remainder of the biomass, is about 100 times that of the best land plants for biodiesel and for -- frankly, for ethanol.

So more capitally intensive. You have to build ponds. This is Mauna Laia. It's a kind of a mock-up. This hasn't happened. We would like it to, see it happen, of course. This is a little plant from which the oil and which the oil is extracted from the algae. This is the power plant. It feeds you carbon dioxide, which is one of the best things that algae do. They love concentrated carbon dioxide. They absorb it all. They take the nitrous oxides out of the effluent gas from the power plant. They feed you back something you can actually burn in the power plant again, so the carbon could actually be burned several times rather than just once or twice. It's a wonderful way to reduce CO2 in the atmosphere.

And then quickly, this is my personal opinion. The -- what can the government do? Well, I think a revenue neutral tax on gas guzzlers, just exactly as Jeff described, where the Hummers cost a lot more, and the benefits from -- to the people who buy gas -- buy efficient cars actually come from the overage that people pay for the Hummers. I think instead of offering incentives to its agencies, the State needs to mandate energy retrofits of the government buildings. Just do it. Don't -- you know, don't try to make it pretty for them. Just tell them they have to do it. Solar water heating on all new construction, it's a slam dunk. Tax gasoline, but make it revenue neutral so that people who do take the bus actually can save something on their income tax as well as not having to pay for expensive gas. There's a much longer list. Outlaw incandescent light bulbs. Forget about it.

Don't try to give people incentives. Those are -- those are the issues that all focus on conservation right now.

In the long-term, the fuel issues, how we drive our cars or our ships or our trains is still going to rely on finding a renewable fuel that succeeds in avoiding occupying agricultural land and destroying potential food sources in the future. I like algae. Of course, we started a company to make it work, and we're working very hard on that, and we have significant negotiations now with people who want to do this. So I think it is the wave of the future. How much land does it take? If you supplied all the diesel fuel needs for the United States, it would take the -- about one-third of the Gadsen Purchase lands. And I hope you all remember geography from the fifth grade when you learned about the Gadsen Purchase. It's not a lot of land. It looks like a lot, but it's really all that much.

Thanks very much.

This little thing right here -- my favorite website is Google Earth. That's Lake Tahoe. If it's a hundred meters deep, all the oil the world will ever burn will fit in that little blue spot. It's a wonderful thing to think about, isn't it? All these wars we fight over something that fits into a small little space like that. Well, anyway, that's energy density. Thank you very much.

THE MODERATOR: Thanks a lot, Barry.

OPTIONS AND STRATEGIES FOR CONTROLLING GHG EMISSIONS
Question and Answer Session

THE MODERATOR: Okay. We've got questions -- for those of you who weren't here this morning, in the back of your packet there are these green sheets for questions. And there are folks in the aisles or on the sides that are collecting these. We'll go through as many as we can. We'll take them in order, so it's first come, first served.

First question is for Brian Kealoha. You suggested turning lights off when not in the room. If the lights are needed frequently, does it save electricity to frequently turn off and on lights, or does it actually use more electricity.

MR. KEALOHA: Yeah, that's a myth that's been out there for quite a while. It's actually -- if you're not -- if the lamp isn't on, you're not using electricity, so you should turn if off when you're not in the room. The only -- the only thing that comes into play there is with fluorescent lamps you want to make sure that the burn hours -- you can reduce the life of the lamp, but there is ballasts out there that acknowledge that. So the general rule of thumb is if you're not in the room and you're not

using the space, turn out the light.
     THE MODERATOR: Thanks, Brian.
     For saltwater -- this is for David. For saltwater air-conditioning, what is the seawater pipe diameter and length and depth, and what type of public hearing or EIS process will be involved with seawater air-conditioning?
     MR. REZACHEK: Well, we're limited on the seawater pipe to a about 63-inch diameter pipe. That's pretty much the state of the art for high density polyethylene and for the suction limits on the pipe. We're gonna -- that type of pipe would supply enough air-conditioning --
     MR. HASHIRO: Could you speak into the microphone.
     DR. RALEIGH: The mic, please.
     MR. KEALOHA: That type of pipe would supply enough air-conditioning for all the buildings in downtown or about 25,000 tons. Just to give you an idea of what a ton is, it's an antiquated measure of one ton of ice melting over 24 hours. But say a hotel room might be half a ton, and your average home might be 2 to 5 tons. That gives you an idea of what a ton is.
     With respect to the EIS process, we've already prepared a draft EIS. We're waiting to get some approval on the pumping station, cooling station, and then that will begin the EIS process where we wil actually go to the Office of Planning and have an EIS prep notice that they've

already reviewed, but they're waiting for some information on approval for that site.

THE MODERATOR: Thanks, David.

This is for Jeff Mikulina. With the probability of an increase in hurricanes, should we allow an increase in the density for the population near the shoreline?

MR. MIKULINA: I don't know if I like this approach where the questions don't come from the person. Don't you get to see your accuser?

But it's a great question though, and that's something that I don't know how much it's been discussed today. Inevitably there are going to be consequences of global climate change, and we're going to have to respond. The IPCC environmental panel on climate change calls for an approach called managed retreat from our coastlines. When you think of the alternative, unmanaged retreat or letting nature do it for us, it's much more attractive to have policies in place where we build further away from the coastline. This is something that, regardless of climate change or not, it make senses both for recreation, for visual beauty, for the -- just the environment itself. But it will be more important, and we'll be working with the legislature hopefully to increase our setbacks from the coastline a couple hundred feet or at least in a way that it's actually linked to the science of erosion. I'm sure

Chip talked about that this morning, erosion-rate-based setback. So it's not arbitrary. It's actually related to what's happening in nature, and we need to get away from the ocean.

THE MODERATOR: Actually, Chip said the beaches were gonna be gone, and he was going to do a change of careers, gonna become a groundwater hydrologist because of the increasing sea level.

This is for David. Isn't OTEC already available as a technology and not 20 years in the future? And what's the source of future energy eventually in the long term?

MR. REZACHEK: Well, as you can see from the -- one of the slides I had, I think that OTEC probably has the greatest promise for Oahu. Yes, OTEC is available now, but it's not available in the hundred megawatt scale size. So we need to probably do a 5 megawatt OTEC plant and then scale up to a hundred megawatts from there. Certainly we could accelerate that process. Virtually every component in the system is off-the-shelf now. The only concern that some people have is the pipe size, which has to be very large. There are a number of developers out there who have solutions to that, so I think, yes, it could be done much sooner than 20 years, probably the next 10 years.

THE MODERATOR: And the second question was, What do you think the long-term energy source is?

MR. REZACHEK: Well, I think we need a mix of all different energy sources. I don't think we can depend on any one source as we're doing right now. We're depending mainly on fossil fuels. We have to have a mix. You saw the equivalencies of all the different technologies. I wasn't saying any particular -- any particular technology was more important than the other. In fact, I would promote the use of all those technologies, which would give us much more than 20 percent by 2020.

THE MODERATOR: Thank you.

Another one for Jeff: Why isn't population growth being addressed since human beings are the cause of global warming? And since population is growing exponentially, all the source production will have to increase. Is the energy, quote, renewable sources exponentially benefit -- infinite.

MR. MIKULINA: Again, you know, that's an excellent question. I don't know if it's -- it hasn't probably been addressed today, and it's not being addressed. That is, the foundation of all of these issues is really population growth. There is a glimmer of hope in that equation though. Some of the predictions in the seventies we've seen haven't come true. Some of the population curves have leveled off. In fact, some of the -- we'll say developed countries -- Scandinavian countries, for example, are actually experiencing negative population growth. Their population pyramids are inversed so much so that the government in Denmark is a little bit worried about their future and a couple years ago had an ad campaign encouraging couples to take the afternoon off and go home and see what happens.

But no, it's certainly a concern because we're seeing obviously a huge development, huge growth in population in countries we'll call developing, and they all have a hunger for the same sort of life-style that we're enjoying. So I think our challenge is to have them leapfrog the painful evolution we went through and hopefully get right to the low carbon solutions that don't mean a lot of sacrifice but are definitely different than what we've experienced.

But population is at the root of that. The Sierra Club has a strong position on population growth. We have a partnership with Planned Parenthood called Planet for the Planet. And it certainly is, again, the big driver behind most of these issues.

THE MODERATOR: So Sierra Club's not advocating people take the afternoon -- couples take the afternoon off?

MR. KEALOHA: Well, go ahead and do so, but do it wisely.

THE MODERATOR: Okay. This one's for Barry. The problem with using trees as carbon sinks is they can burn, returning CO2 into the atmosphere. Climate change is causing drier conditions in some regions. How is this challenge being addressed?

DR. RALEIGH: If you step back from the microphone a little bit, I have a trouble hearing you because of the echo. Say it again.

THE MODERATOR: The problem with using trees -- trees as carbon sinks is they can burn -- or they can burn, returning CO2 to the atmosphere. Climate change is causing drier conditions in some regions. How is this challenge being addressed?

DR. RALEIGH: I don't know. Jeff, why don't you try that.

MR. MIKULINA: Actually, I don't think Shanah has responded yet.

DR. RALEIGH: Okay.

MS. TREVENNA: It's true.

It seems that that can be addressed thinking about carbon credits in a way.

Of course. Somewhere my grandfather who's been telling me to slow down for 30 years is smiling.

So it seems like there's two questions in there. But with using trees as carbon sinks, when we -- I guess when money is spent to offset your carbon use, it's now being encouraged, but to go with -- use -- invest in renewable energy. So that's one -- that's one thing we're turning away from. But as far as actually absorbing carbon in another way, I actually don't know another way besides that. If -- does anyone else in the panel? Right. So I guess the best you can do is if you're doing carbon oxiding is to invest in renewable energy rather than replanting. But it doesn't -- doesn't feel intuitive, I have to admit.

THE MODERATOR: Thanks Shanah.

Now this is for Barry again. Doesn't coal have enormous social, labor, and environmental impacts other than greenhouse gas emissions?

DR. RALEIGH: You'll have to tell me again. I'm sorry. My hearing's not good.

THE MODERATOR: I said, Doesn't coal have enormous social, labor, and environmental impacts other than greenhouse gas emissions?

DR. RALEIGH: Oh. Yes.

THE MODERATOR: Thank you, Barry.

DR. RALEIGH: In a word, it's -- in West Virginia you -- some of the places you really don't want to go anymore. It's a beautiful state. There is -- there is a big environmental price to pay for mining coal at the rates and volumes that we're mining it. It doesn't mean that it isn't reparable, but it's a long time before it can recover, the landscape can recover to something like a normal landscape. What else are you gonna do I guess is the issue. So nuclear power doesn't seem to be any more palatable for a whole host of different reasons.

THE MODERATOR: Okay. On that note, this is for Shanah. And I've asked her to speak slowly, and I won't do it for 30 years. Do you see Sustainable Saunders as extendable to the entire Manoa campus? Also, why aren't all the buildings on campus metered, both for electricity and water?

MS. TREVENNA: Thank you so much for asking that question. I definitely believe Saunders should be a model. The buildings are divided into different categories, so there are some buildings that are labs that use actually a bit more energy, but a lot of them are very similar to Saunders, first of all.

And metering is the key, in my opinion. If we can show communities the information they need to make decisions in their lives, and if we can take the savings that occur and put them into revolving fund that then is invested back into the community, even -- either in the form of incentives or in revolving funds for grants for more sustainable projects, then the community actually has in its hands the power and the incentive to make decisions. So a metered building where that information is shown on a daily basis -- you can walk in and see it on a screen or kiosk -- would give people in the community a reason if there's -- being able to see the energy data would give people incentive, would give them the tool to know where they're at and how their behavior can -- is reducing the amount of energy use in their room or their floor.

If the money that they actually save goes back into their hands, I think that's the most powerful way of getting people to change their behavior. Once we show and prove that behavior modification makes the impact that I think it will, I think other buildings will adopt that, and I think a dollar incentive will be one that other buildings are excited about as well.

MR. MIKULINA: I'd like to add something else to that as well because I think you're right on. And the other portion of it is really the structure of these different buildings. You know, the study that was done for Sustainable Saunders pointed out a lot of opportunities there for efficiency. But how do we get -- how do we move forward on that? And the first part of that is looking at the longer range benefits of being, you know, more efficient and more renewable and appropriating those funds for the longer term, which will include also the metering so people can see behaviorally what they're doing, coupled with the infrastructure of the building, will really help making Saunders really a demonstration model for the rest of the campus that can be easily employed.

THE MODERATOR: Good. Thanks. Thanks very much.

This is for anybody on the panel. Rumor has it that all of the recyclable material -- all recycling materials are burned or shipped off island ostensibly to the third world -- to third world landfills. What happens when we drop a bottle in the blue bin? If it ends up in the power plant what's the point?

MR. MIKULINA: I don't know why you're looking at me.

Seventeen percent of Americans also believe in alien abduction.

But it is true we do recycle offshore. Most of the recycling happens either in China or in California, and we're probably not going to see any heavy recycling industry here. Most of that stuff though is shipped. It's not sent to H-Power, regardless of what the current mayor is suggesting, that incineration is recycling. True recycling is taking place, albeit in California or elsewhere. There are -- there are other issues obviously surrounding recycling plastics, recycling aluminum. It's energy intensive, and there's probably other moral questions about who is actually doing the work, but that's the situation that we're in now.

But it does save energy. I think the calculation's about 5,000 bottles or cans is about a ton of energy or greenhouse gas savings. There's a minor cost for shipping, but the marine cost, these boats are going back largely empty anyways, so it's not that large in the equation. But that's the current situation we have. Recycling is still far beneficial than throwing it in our landfill or incinerators.

THE MODERATOR: The person with this handwriting must be Jeff's straight person because it was another question. I was wondering if you would talk more about the structural and institutional barriers to change, like corporations or racism or class or corporate-owned media. You mentioned Wal-Mart, for example.

MR. MIKULINA: Okay. How much time do we have?

Wal-Mart's a great example, actually. And we beat up on them for a lot of reasons, rightfully, but they're the big, hundred pound gorilla. They contracted with Rocky Mountain Institute to look at how they can save some energy. One of the impacts is they move so many goods. This is a company that does what, 300 billion dollars in revenue a year. They move so many goods across the country that just small changes to their trucks, putting on baffling on the semi-trucks to make them more aerodynamic, saves them a huge amount of money.

Similarly, on their products that they sell side, as soon as they started carrying compact fluorescents and promoting those, you reached a whole 'nother spectrum of the audience that Sierra Club probably isn't gonna reach and maybe some of the folks here even have difficulty reaching because they don't spend a lot of time at Wal-Mart. So in that way they can be huge change agents.

Structural and other problems, yeah, everywhere. Again, these barriers, it's not -- it doesn't take a rocket scientist to realize some of the barriers that exist that prevent people from doing the right thing.

One story, it's kind of stale now, but about five years ago there was a clear institutional barrier at the Department of Education here. Someone can correct me if I'm going astray, but they wanted to do daylighting in some of the schools. They showed, as Shanah talked about, daylighting is great for a lot of reasons, lower energy costs. They've even shown higher test scores in schools when people had natural light. But as soon as they went out and tried to do this, the Department of Education came back and said. We have a rule of no holes in our roof, so we can't do daylighting. And it was a rule that was written down somewhere probably for expense reasons at some point in time, but it was a huge hurdle, and it prevented a very good idea from taking root, and I don't know if that ever got resolved.

But those are some barriers that can make doing the right thing very difficult. There's infinite others, but it would take all afternoon.

THE MODERATOR: Okay. We'll give Jeff a break.

I think this is probably for Brian. Is there a problem recycling or disposing of compact fluorescent lights?

MR. KEALOHA: That's probably the biggest issue that we've found, that California -- Canada's looking into that. It's the same thing that's coming up in California, that there is a mercury content within compact fluorescent lamps. And are we ready to handle, if we were to outlaw incandescents, the amount of recycling that would be required? So it is an issue. I guess with every good thing there's a little bit of bad. They are beginning -- you know, manufacturers are moving forward and putting in low mercury lamps to try to get around this problem. But as it exists today, if you were to outlaw a technology completely, you would have some recycling issues.

THE MODERATOR: Thanks, Brian.

This one's for Barry. It's about algae for biofuels. Would you use local algae, native or local algae? Would you use -- would it be genetically modified? And how would you keep it separate from native species if it is imported or modified?

DR. RALEIGH: Well, at least in our own case, we're not -- we're not using anything except for very normal algae that -- the species that we've used so far actually come -- were collected in Hawai`i.

The National Renewable Energy Laboratory actually sponsored a program back in the eighties for producing biodiesel or diesel feedstock from algae. And it was a huge program, 25 million dollars. They collected algae, a lot from warm climates because they seem to do better here, as you -- if you have a swimming pool, you well know. And consequently, that collection, subsequent to the closing of the program, actually has arrived -- has been at the University of Hawai`i. So we had access to all the algae that were collected at that time. And the ones we're using right now that we're screening have come from Hawai`i itself. But there are others -- there are others that have come from other states or other places and sort of the subtropical United States that hopefully could be useful in the future.

We have not developed, nor are we working on developing, a gene-spliced organism. And a GMO -- the GMO is an inaccurate description for what you do, but what it really means is it's a chimera. You take genetic material from some other organism and stuff it into another one, and you -- you develop a creature that you're nervous about because you don't know what it might do. And we -- we're not doing that. That's kind of a no-no. Just -- it avoids too many -- it raises too many problems, and we're just not gonna do it.

THE MODERATOR: Thanks, Barry.

This is addressed to Shanah, but I think it could be Shanah or Jeff. It's questionable that the present generation of leaders are going to be able to reverse global warming. Our best hope may be the world's youth. What do you feel is the best way to get them involved in positive action?

MS. TREVENNA: There's a quote from a student in California who's 25, and he said, It's no longer time for empty protests and frustration and anger. It's just time to step up and do every small thing we can to make a difference. And it seems to be what's echoing across campuses, that there are student leaders on every campus that are rising up in a way that we -- that's different from the sixties. We're united through the Internet and through MySpace, that sort of technology. We all have cell phones. We can reach each other. We are able to travel to see each other and get together. And the vibe is really constructive.

So I think that, you know, even in the U.N.'s step-by-step protest to evolve a community, they say the first thing to do is to unite the fire souls, and those are the people that just are really passionate. And when they find each other, it's almost like a little cluster of light. They create a beacon and somehow -- I've only been -- I moved here from Canada in August, and already we've formed a large student group on campus called the HUB, standing for "help us bridge," not watch us protest. You know, it's a different -- it's a different energy. So it's happening really, really, really fast by -- I would say the only thing that needs to happen on campuses is that we get given the green light as much as possible. Every time that happens, it seems to be really, really successful and move quickly. The only time there's ever a lag is when there's a rule, kind of like Jeff was talking about.

For instance, why don't we have solar on every roof on the campus? There's one small rule in procurement that we're working on right now to figure out. So it's only when we're blocked. So I would say allow the students to unite, allow them to communicate and travel to see each other and give them the green light as much as possible.

MR. MIKULINA: Let me follow up. You mentioned this current generation of leaders, and I think the underlying thought behind that is that we somehow have these leaders that will be in there for the next number of years, and we forget that we're fortunate that we live in this democracy where in the next two to four years we can have a whole brand new set in every level of government. So it's really up to the people, up to us to select those leaders.

I think with this issue things are happening so quickly, there's just, like I said, a sea change, support that's growing behind this issue, and particularly through young people looking at the future and seeing how this is going to impact their lives in a dramatic way. I think it's going to be just controlling that flood of interest and getting the right people in office.

Just as a side note, I've been going around giving a talk -- I see some other people in the room -- the Gore talk of the Inconvenient Truth presentation, given it about 20 times. Two audiences stand out as being the best by far. One was the Kahala Nui senior center. It was an afternoon talk, and it was an hour of a hundred percent attention, a lot of incredible questions, just really involved, great. I don't know if it was the medications that day or what, but it was impressive. Their questions were, What can we do about it? I'm 85 years old. What can I possibly do? Give us money.

The earlier one was Punahou School, and it was the sophomore class at Punahou School right before lunch, and I was dreading it because I remember being a sophomore in high school, and the last thing I want is some dude giving a Power Point. But it was fascinating. I mean, the questions that were asked were beyond me, just all eyes glued. And it was kind of taken back. Steve Meeter [phonetic], who some people might know, his son was actually in the audience, and I didn't realize it, and later Steve told me that his son brought up the talk and said, This guy was talking about climate change. We get it already. Just tell us what to do. So that was kind of encouraging that, you know, no longer do we have to be going through the charts and talking about the science. They get it. What do you do next? What's the next step? What are the best solutions? How can we be effective? So that's how they respond.

MS. TREVENNA: I just have to quickly agree with that. Never in one conversation with any of the student groups on campus has there had to be a debate whether climate change is real or not. So we're just starting on a unified platform of let's just get something done in any way possible. And no one has lost steam. These students have taken on projects because we use that whole pull philosophy of push, and we really try to reposition sustainability as something that's fun, something that's really progressive and -- and even one of our logos is Sustainability Is Sexy, which got a whole article written up in the paper when someone wore one of our T-shirts on the Big Island and got questioned about where that T-shirt came from. Just make it fun, and just let them loose. It's really a fun process to be involved in and to watch.

MR. MIKULINA: And if I could add one more dimension to that, I mean, obviously, what you're hearing here, the youth can really effect change, and it can affect what we consider ourselves, I guess, the older generation because those of you who do have kids, you know if your son or your daughter says something to you like quit smoking or turn off the lights, I mean, they can help also change the behaviors of the generations that maybe aren't as aware. And so it gets back to teaching them what do they need to do to make a difference, and that's where it really all starts.

THE MODERATOR: Thank you folks.

Let's give them a big round, a hand, a big round of applause.

We're going to take a break in a minute. I will just -- I'm gonna have to leave. I had a previous engagement on the Big Island, so I'm going -- I'm going to Volcano. I'd just like to thank the audience for being a great audience. Everybody stuck with it. And thank all the speakers for a great day. So I'm going to turn it back over -- I'm going to turn it over to Terry during break.

(Whereupon, a recess was taken from 2:46 p.m. to 3:00 p.m. Dr. Terry Surles is now acting as

The Moderator.)

THE MODERATOR: Okay. If everybody could have their seat, we're getting into the home stretch. And we have three speakers and then some final closing remarks from the folks from Hawaiian Electric. And while everybody's sitting down, because -- because Mike Hamnett had a prior engagement at a toga party, as for those of you who remember me from this morning, I'm Terry Surles from Hawaii Natural Energy Institute. So with that, I think we'll get underway.

Carl Freedman -- again, all the biographies are in the back of the materials you all have received. Carl Freedman is the first speaker. Carl.

INCORPORATING CLIMATE CHANGE INTO THE IRP PROCESS
HOW DOES THE REGULATORY PROCESS WORK WITH GREENHOUSE GAS?
Mr. Carl Freedman, Haiku Design and Analysis

MR. FREEDMAN: Hello everyone. Can you hear me okay?

AUDIENCE MEMBER: Aloha.

MR. FREEDMAN: I was having a little trouble hearing. I'll give my sympathy here to the court reporter. It was challenging for me. If somebody can't hear, just give me a little wave back there.

I'm going to keep my comments focused on a very narrow aspect of all of this, and I'm also going to treat it in a cursory manner, so things should be concise, I hope. I'm going to focus on Act 226, which is the house greenhouse emissions bill, and I'm going to focus on the interaction that that has with the Integrated Resource Plan process and the utilities in particular.

House Bill 226, as I understand it, has not been signed by the governor, but we don't know that it will be. It doesn't have an act number, yet so I'm just going to call it House Bill 226 for now, but it's our greenhouse emissions bill. It sets out a very clear policy about greenhouse emissions. We're gonna -- Hawai`i is to reduce emissions to 1990 levels by the year 2020. As far as policy goes, that's about as clear as you can get. It sets out a process and some criteria that describe how that policy is gonna be implemented.

The criteria are to divide -- to determine the maximum practically and technically feasible and cost-effective reductions in greenhouse gas emissions, and it identifies a process that forms a task force that is to prepare reports and recommendations to the legislature to -- for analysis and gather information and ultimately, by the year 2012, after this has been perhaps acted on further by the legislature and rules have been drafted by the Department of Health, should result in some sort of mandates and rules.

Now to some of us in the IRP process, who have been in the IRP process, some of these elements and approach seem rather familiar. We're starting with a policy. In the IRP process we start with identifying what the objectives are and what the criteria we're going to use to determine what resource mix or what plans will be selected, and then there's an information-gathering phase where we look at demand forecasts and supply options and demand-side management options. There's an analysis section where we're doing some analysis. And ultimately, there's a recommendation made about a plan, and then it goes on for review by decision-making and then implementation. So there's some parallel approach here in terms of policy and then analysis, decision-making, and implementation.

And, of course, there are some differences that I want to highlight. First of all, the state policy in Act 226 is regarding reductions in all sectors. And the IRP process, of course, involves the utility sector. And, of course, we know that a substantial portion of greenhouse emissions are other than utility. Act -- or House Bill 226 also addresses greenhouse gases in particular with consideration of other factors whether -- where IRP addresses a whole list of factors, one of which may be greenhouse gases.

The venues are different. The statewide process is gonna be done by a task force, and decisions will be made ultimately by the legislature and the Department of Health and rule-making whereas the IRP process is the utility process implemented by the utilities, and ultimately decisions are made by the PUC. But these -- these similarities and differences are important to understand the relationships between House Bill 226 and the IRP process.

So I want to talk about a few ideas, and I don't want to pretend to have done any exhaustive -- exhaustive analysis of all of this. In preparation for this, I read the statute carefully and scratched my head and thought about what I knew about the IRP process. But I haven't actually talked to very many people out there about what -- how this all may spin out. And in my experience, really, that's that you have to do to figure out how things are gonna work, is to get a lot of people's ideas. So I feel like I'm talking a little blind. So maybe some of you will take me up in the questions and enlighten me about some of this.

But here are some thoughts. I think it's clear that House Bill 226 eventually may provide some specific mandates to the IRP process and to the utilities, but we're not there yet. Right now HB 226 has established a policy, and although that policy is very clear, it still does not get to any specific mandates that need to be met by utility sector. It has policy, criteria, and a process, but the analysis section and the decision-making and the rules are -- they're still gonna happen. So in terms of the short term, we have -- we have no clear mandate to the PUC or no clear mandate to the utilities as to do anything particular in particular now. An example, the state policy, of course, is a statewide mandate, but it has not been determined what percentage of that will be met by the utility sector.

In the near term, I think one thing Integrated Resource Planning can do is inform the task force, I mean, regarding that particular issue. How should reductions be allocated to the different sectors? And a corollary question that you have to ask is, What is the cost of unit production by sector? You know, is it cheaper for the utilities to reduce greenhouse gases than it is for the transportation sector? Or how much reduction can be obtained in these different sectors? Those are questions that the task force needs to answer. And I think the Integrated Resource Planning process can inform that decision. The -- it's an optimization type of analysis where you look -- you can look at different scenarios. You can figure out if we were to do this, it would cost that much. You can provide information that way that could be valuable to -- to the task force.

So basically I guess what I'm trying to get across here is I think that Integrated Resource Planning is a good venue for analysis. It provides a lot of good information. Integrated Resource Planning is also a venue for implementation and enforcement. And regarding House Bill 226, I think the first role it has to play, I'm suggesting, would be to provide some information to the process, provide information to the task force. And ultimately, when the task force has something to say about -- about that reductions must be taken into account, then Integrated Resource Planning process -- it would be an effective way to implement that.

I want to talk a little more particularly now about greenhouse gases in the IRP process itself. And I -- I want to make the point right off that I'm throwing some ideas out there. There are a lot of different ways this could go, and certainly the Public Utilities Commission has an enormous amount of discretion about this. The PUC could sit in the back seat on this issue until it has to do something, or the utility -- or the Commission could be a real policy driver. Without any further requirement by the legislature, the PUC could push the issue. That's up to them, similarly with the utility. The utility doesn't have quite as much discretion as the PUC. They have to do what the PUC says in most cases, but the PUC -- but the utility can push this process along. I mean, we're all here today at the initiative of the utility, as I understand it, to look at this issue.

So in the IRP process we start with the objectives and the criteria that we're gonna -- that are used to evaluate plans. And those -- those objectives are usually identified by the utility. And they have always included gas emissions, and I think carbon emissions have been identified as a list of criteria along with cost, minimizing cost, reliability, environmental impact, economic effects, a whole list of criteria.

And one thing is I think the Commission also could step in and identify some objectives. In fact, in the IRP framework it explicitly says that the Commission can identify specific objectives at the beginning of the IRP process. I don't think it's ever done this explicitly. I haven't seen the most recent orders that have come out, so I don't know if they have in the most recent round.

The other -- the other aspect of objectives and criteria is that they can be -- they can either be things to be optimized in the process, like which one of these are the cheapest, or which has the least environmental effect, or how much can we reduce carbon emissions? They can also be stated as specifications. In other words, all plans will meet these specifications. Like system reliability is treated that way, for example. All the plans that are looked at in IRP provide reliable service to all the customers.

And, you know, greenhouse gas emissions, if they become a mandate, could graduate from something to be optimized to something that's simply specified. All the plans will meet the greenhouse emissions targets that are set by whomever in the future when those are -- when those are set.

And similarly, in the IRP process we can look at different scenarios. We've looked at many different types of definitions of candidate plans or scenarios to meet particular things. You know, what would happen if we were to maximize the use of renewables? How much would that cost? approaches like that to answer questions. And certainly one thing, and perhaps in the next round of IRP or as a separate study parallel to the IRP or using the IRP tool -- analysis tools, that type of information could be looked at to aid the task force. How much will it cost per unit of reduction using various of those strategies? And along that line, even aside from the IRP process, the utility, using some of the IRP tools, could address specific questions.

And the last -- the last specific part of the IRP framework -- I mean, there's part of the IRP framework says that all utility plans shall comport with normally adopted state and county plans. I mean, it sounds like I'm reciting that verbatim. That's a paraphrase. And the PUC has not felt compelled in the past to obey policies unless it's mandatory. But clearly if 226 graduates to the point of being mandatory, it's clear that the IRP framework would follow any mandates on the state and county level.

So in addition to the IRP process, the Public Utilities Commission could open a separate investigative docket. I'm not recommending anything here. I'm just kind of going through options. And actually, there are some things that could happen outside of the PUC's jurisdiction, I want to mention, that wouldn't be done by the PUC. One example, I know a number of people have talked about carbon taxes. And one option that we explored in a study for the forum was to take the existing taxes on utilities that are on revenues and take the same amount of taxation, you know, revenue neutral, but denominate it by carbon. So you take the same amount of money, but instead of per dollar, it's per amount of carbon. And that amounts to about 1.1 cents per kilowatt hour. So you'd be shifting -- you'd be giving an incentive then to non-carbon-emitting solutions of about a penny, little over a penny a kilowatt hour.

And I think the moderator's walking. I've got one minute.

I guess the last thing I want to leave you all with, I have it down here as "just worms" as the last topic, as the last topic. I feel sometimes talking about greenhouse gas issues that we're on a veneer of analysis that's suspended over a huge can of worms. And I think Henry pointed out, made some good points about the need to look at some details of the analysis. You need to look at details. And if you just say emissions and you just look at tail pipes and smokestacks and you don't dig any deeper, you may not look deep enough to make sure that we're really doing something constructive about global warming. You do need to look at details, and I think this is gonna be a challenge to the legislators, a challenge to the agency administrators and the PUC to look at enough details for the analysis to be meaningful, and yet if you really look at the details and you dig deep enough, it's very difficult not to get into a whole morass of details about how -- how do you scope out the limits of all the different things? How far do you take the impacts of carbon back to the mine mouth or back to the workers in Indiana? Or, you know, how far do you push the scope of this analysis? And I think the challenge to the regulators is to look at the details to get meaningful analysis, but don't get mired and lose sight of the prize, which is to really -- really implement some forward-looking policy. Thank you.

THE MODERATOR: Thank you, Carl. And thank you for being timely, too.

And now for a man who needs no introduction, because he was introduced this morning, John Tantlinger.

HOW DOES THE STATE GOVERNMENT PLAY A ROLE?

Dr. John Tantlinger, DBEDT

DR. TANTLINGER: Well, hello again, and let's see if I can get this up.

For anyone that was not here for my presentation this morning, thank you very much for joining us this afternoon. For those of you who were here for my presentation this morning, thank you very much for joining us again this afternoon. This is just as tough a crowd as it was this morning.

AUDIENCE MEMBER: Yea.

DR. TANTLINGER: Actually, you know, I'll be very honest. I wasn't even prepared to do a Power Point presentation this afternoon, but Henry Curtis inspired me. In fact, I'll be brutally honest. I had not even prepared this afternoon's presentation, but I'd given it considerable anxious thought. And the name of the panel is Incorporating Climate Change Into the IRP Process, and my presentation was invited to provide comments on the question, How does the state government play a role?

And I'd been considering talking with you about how the state statutes assign different state agencies, you know, their various missions and functions that would support the state government's various roles in energy and in BUS and IRP; and, for example, the Public Utilities Commission as the quasi-judicial regulatory and decision-making body; the Consumer Advocate's role of being the representative of the ratepayers' interest in regulatory proceedings and so forth; and those agencies and other agencies, how they take their mission and functional guidance on climate change and greenhouse gas policies from any related laws that the legislature or even the federal government might enact. And then assuming DBEDT would have a role under those statutes, because of DBEDT's existing statutory role with the Director as their state energy resources coordinator, DBEDT would then also do its part in implementing that policy guidance.

Then, as I was walking back to the office at lunchtime from this morning's session, I had what I've heard referred to in the past as a BFO -- a BFO, that's Bravo, Foxtrot, Oscar -- a blinding flash of the obvious. And, you know, maybe it's just my age. Maybe it's my memory going, but state agencies actually are and have been involved in attempting to incorporate greenhouse gas reduction policies into the IRP process for quite some time. And from this point, what I'll do is be speaking about this from DBEDT's perspective.

DBEDT's participated in all of the utility IRP processes since IRP was adopted in this state. And DBEDT, along with several other energy stakeholders, some of whom are here today, advocated for and participated in the development of Hawai`i's IRP framework. Since that time our agency's primary role has been to assess, analyze, provide information or recommendations and aims specifically at encouraging and influencing the Hawai`i utility, the utility IRPs, to comport with, as Carl said, Hawai`i's state energy policy objectives, because that's consistent with the IRP framework. And even absent IRP, these state energy policy objectives are state law.

So this morning I presented background on the state's greenhouse gas inventory estimates project. And then I also showed you the findings of our recent preliminary recalculation of those emission estimates. And what I didn't cover this morning though were some of the outcomes that might be directly or indirectly attributed to that project as well as the phase two component of that project where a variety of recommendations were contained to reduce greenhouse gas emissions in the Climate Change Action Plan that was developed. In the interest of time, and frankly, because I did run out of time putting this together, I'm only gonna touch on a few. And I look forward to more discussion after the panel presentations.

First, the greenhouse gas inventory project spanning 1994 to 1998 was a DBEDT initiative. But it became a strategic partnership with DOH, UH Environmental Center, DLNR, Department of Agriculture, PUC, counties and numerous others. At the time only 12 other states had developed greenhouse gas inventory estimates. And as I mentioned, the two grants that we received from the EPA were competitive awards. So Hawai`i's proposals had to compete against several other states for the funding. DBEDT's role -- and it has been and it continues to be one of coordination, analysis, information, and initiatives to develop and propose energy policy and planning initiatives and advocate projects that have been evaluated and found to be supportive of those state energy policy objectives.

And I think that the state's energy program, particularly under Maurice Kaya's leadership, has done its best to itself be a leader in these areas. And this means, however -- you know, leadership means understanding one's limitations and cooperating with others in order to leverage their strengths and leverage their actions. An example of that was how the greenhouse gas inventory project and the climate change action plan recommended adding greenhouse gas reduction language to Hawai`i state laws. However, getting that recommendation adopted was something that actually took a great deal of cooperative effort and ultimately then the decision by the legislature and the governor. And the result is shown on this and the next slide thereafter.

In 2002 the legislature did enact a change to the Hawaii Revised Statutes. Chapter 226-18(a) easily state's energy policy objectives, and you note up here -- if I can get the pointer -- planning for state facility systems with regard to energy be directed toward achievement of the following objectives given due consideration to all. This is one them: reducing, avoiding, sequestration of greenhouse gas emissions from energy supply and use.

And this is a summary of the next level of detail in that statute. And you can see them down here. These were also adopted in 2002. This was just one of the recommendations in the DOH/DBEDT Climate Change Action Plan, development of which was due to the participation of all those others stated. DBEDT's analytic review and comments on Hawai`i utility IRPs from the very -- from the time this began, these policy and policy objectives are among the criteria that we use when we look at our IRPs and provide comments back.

Paraphrasing one of the speakers this morning, results don't necessarily get accomplished by mandates, especially when the mandates are not adequately funded. Now that's a fact. But on the other hand, when it comes to changing behavior in a society and an economy based on the rule of law, I think it's at least a good place to start.

Now I've been with the state energy program for nearly 20 years. Prior to the greenhouse gas inventory project and an enactment of these statutes, I don't recall greenhouse gas emission estimates ever appearing in the utilities' analyses of their own resource options in their own plans. So from DBEDT's perspective, our role of analysis, information, coordination, and development of partnerships within the ER -- within the IRP process to advance these objectives, I think they appear to be -- it appears to be a useful role. It's important to emphasize that our role includes in these partnerships the utilities themselves. Because our perspective really is that our constituencies, our customers, if you will, really encompass all the energy stakeholders in the state, we believe that it's consistent with the role that's been designated to the Department and to the energy program under the structure of the law that outlines the ERC's functions and responsibilities.

Now in 2006 several very important energy laws were enacted. Again, in the nearly 20 years Maurice and I have been with the state energy program, this energy legislation was absolutely the most comprehensive ever. And those laws reflect, we think, pretty much in some form the majority of the energy -- the administration's energy policy proposal in 2006. That was labeled Energy for Tomorrow. Prior to that, the RPS law was also something that DBEDT played a part in. And many of these policies directly relate to utility IRP processes, and to the extent that they reduce greenhouse gases, they certainly relate.

Again, using greenhouse gas and carbon emissions as a method of assessment, we did a conservative estimate of what the governor's policy initiative would have produced by the year 2020 in terms of benefits. And you can see here that this is one of the major focus of that effort. We think that the laws that were enacted in 2006 can achieve similar benefits as you see estimated here as long as they're implemented effectively and adequately resourced.

Now -- so from the State's -- from DBEDT's perspective, the State's role in IRP is to advance these policies and other policies that relate that are passed by the legislature, and we will continue, to the extent that we are able and so chartered, to participate in the IRP advisory process and other processes to advance those policy objectives.

So, again, thank you very much for this opportunity to speak with you. And again, thanks to HECO for inviting DBEDT. Thank you.

THE MODERATOR: Okay. Thanks, John.

And now Darren Kimura is here, who's agreed to summarize all the preceding 14 talks with his. Only kidding, Darren. So Darren Kimura from Energy Industries.

WHAT KINDS OF THINGS CAN UTILITIES BE DOING?

Mr. Darren Kimura, Energy Industries

MR. KIMURA: Okay. Let's see here. Can everybody hear me okay?

Just a little bit of background on myself, I've been doing energy in Hawai`i for about 14 years now, so a lot of what we've done has been in efficiency. We've also done some renewable energy development. But aside of that, we've also done a lot of projects with utilities from across --

THE MODERATOR: Darren, because we do have -- sorry. We do have a court recorder here, you got to slow down.

MR. KIMURA: Slow down. So I'm speaking faster than she was.

Okay. But the point that I was trying to make with that is we have a lot of other experiences with other utilities -- still too fast -- with other utilities across the country as well as internationally. So my task was to try and summarize what utility -- what kinds of things that utilities can be doing to help prevent greenhouse gases, and that is big task. That's quite a challenge. Now being that we've sat through 14 different discussions already, I'm gonna assume that you're all experts on the cause of greenhouse gases and what's been -- what's going on out there. So I'm not going to talk about any of that stuff in my presentation here.

So what I wanted to do was really summarize it as four major categories that utilities -- what utilities can be doing to help combat greenhouse gases. Now, of course, this is a big topic. Quite frankly, this is gigantic. And there's a lot of different things: carbon sequestration, different things with scrubbers. I've decided not to talk about any of that, so I'm pretty much going to be focussing on the support of clean green energy.

The four topics are projects, green power pricing, renewable energy certificates, and the feed-in tariff; on the utility side, power purchase agreement and interactions; on the education side, consumer outreach; and in investment, projects and companies. But at the core of these four major things comes back to one major topic, and that's corporate transparency, letting us know what utilities -- not necessarily just Hawaiian Electric, but utilities in general are trying to do, want to do, and will allow us to do with them.

So the first thing that I did here was really kind of identify what other utilities are doing out there. I took a look at the Energy Information Agency and really found that most utilities are doing something with regards to green power selling.

Here's an example of a utility in Seattle, Seattle City Light, where they have two major programs. One program is called Green Up. That program allows consumers to purchase green power, a percentage of green power monthly for a fixed cost. That monthly charge then goes back to a renewable energy developer to help them offset the additional cost of producing power with their renewable energy resource, whether it be wind or solar, geothermal or other. So this additional cost that is on top of your existing bill helps to incentivize other green projects to occur in that utility territory. In Seattle I actually do this for my place in Seattle. You can pay $3 and get 25 percent of your bill offset by green power all the way up to 100 percent per month for $12. Again, that money is being used to help build future green renewable energy projects in those territories.

Now on the other side, Seattle City Light is also doing something very interesting. They also have a voluntary program where you can donate any amount of money that you want. That money goes into a fund which is similar to a grant, and that fund is used to do community outreach, community education, community type projects. So, for example, they've actually done the installation of photovoltaic on community centers, on parks. They use that money to help incentivize that type of activity. So this is already being done by Seattle City Light, as well as a handful of other utilities around the country today.

Now another thing that can be done is the utility facilitating the use of renewable energy certificates. Now renewable energy certificates are also known as RECs. Sometimes they're called green tags. Essentially, it's a separate commodity. When you buy -- when you're an energy project developer, you create your power from your -- let's say we're talking about a wind project. You create your power from your wind. On top of that you also have your environmental goodwill, which is your REC. You can use that REC and sell it to the public markets or to the local and state markets if there's a commodities-based market established. And you use that additional money to help you -- basically help the economics of your projects. That REC makes your project better. And I've got a slide which will show how that works.

So what I really wanted to do was really kind of have this thing hit home, so what I decided to do was I calculated all of the energy that I used in building this presentation: the air-conditioning, the time, the gas to get to the office, the electricity from the laptop computer. Then I went to a website to purchase a REC. I put it into the website in a very, very easy form, put the kilowatt hours that I was using in, and basically was able to purchase on line this certificate. So the presentation that I'm delivering to you today is actually powered by green power. I paid something like $57. I got the offset, the renewable energy certificate, which went to a project developer, to help me offset the cost of energy and the emissions ultimately that I used to build this presentation.

Now, of course, there are other things that you can do. You can offset your car travel. You can offset your air travel. I've actually been in airports where there are kiosks similar to ATMs where you can actually go there, input the designation to where you're going, pay a fee, and you will then be using or purchasing an offset to help incentivize, again, that problem to deliver the -- whether it be reforestation or sequestration or green power generation that is helping to basically offset your travel.

Another thought that I had was, you know, I did this for my presentation. Could these kind of things be done for things like this, conferences like this? Yes. I was at Sun Power 2006, and the entire conference was offset via REC by a trader, and that was done in San Jose. So these are the kinds of things that are being done by utilities right now to help incentivize projects, green power projects.

Now here's a slide I talked about earlier. How does buying a green tag help a renewable energy project developer? Well, essentially here's what it is. In this case I picked a utility that was similar in size to Hawaiian Electric. This utility is Atlantic City Electric. They're also investor owned, about the same size as Hawaiian Electric. They currently have a program where you can purchase power from four different independent power producers at a preset amount; in the case of the first yellow box, 1.3 cents per kilowatt hour, which roughly equates to about $9.10 a month for the offset from that utility.

Now what does that mean for the energy project? Well, essentially, if you were doing a 10 megawatt solar project, at 13 cents per kilowatt hour, your revenues is about 2.3 million dollars. Not bad. Could be better, obviously, if the -- excuse me -- the cost per kilowatt hour went up.

At 13 cents per kilowatt hour, it doesn't make a lot of sense for a lot of green power producers to build their projects. Generally speaking, you want to be at about 15 cents per kilowatt hour to make your projects make sense.

Now when you add that green tag, that 1.3 cents per kilowatt hour on top of the 13 cents per kilowatt hour, it becomes a lot more economical. So at the end of the day, what that means for the energy project developer is an additional $236,000 a year. Now that's 10 percent for that energy project developer. From a project developer's standpoint, on a pro forma basis, that's huge. Most utilities, most businesses struggle to get a one percent profit out of their business. Here, by one cent, we're helping them get 10 percent. This makes a pro forma work. This helps project developers build projects.

Now a lot has been done outside of the United States to help incentivize green power or clean energy. One of the biggest things, if you ask any project developer out there, is the feed-in tariff. What exactly is a feed-in tariff? Well, essentially, it allows renewable energy projects to tie directly into the grid and sell their power for a very, very high rate. At the end of the day, the rate could be very high, as high as 60 cents per kilowatt hour. So, for example, in Germany where they have a very famous feed-in tariff, people are installing photovoltaic systems on their rooftops, selling back the power to the utilities, and actually becoming net minus fuel emitters of carbon. They're actually being -- they're actually selling back all the environmental goodwill into the grid.

Here's an example of how the feed-in tariff works or what it did, essentially. The yellow box there shows you the landscape in Europe before feed-in tariff. When feed-in tariff went into effect, it basically paid more for green energy. As you can see, the bars go up. A lot more people are doing it, and not just on the large scale, not just on the utility scale, but also on the home scale. So it essentially helped to kick-start the marketplace there. And as a result of the European feed-in tariff, other countries have also jumped in, Ontario being the last, but also Portugal and Spain having very, very popular feed-in tariff mechanisms now.

Now to make a feed-in tariff work, the utility has to want to want it to work. At the end of the day, it doesn't work if the utility is not going to work with the government to make the feed-in tariff work. But this is one of those kinds of things that utilities can be doing today to help incentivize green power.

One of the other, I think, important things that needs to be done is good education to the consumer level, and not just the consumer, but the industry professionals as well. We've got great programs like the Jade Moon commercials and radio ads and you see print ads as well that you see now. These are great, but they don't necessarily educate. They do a great job of showing a bunch people in the audience with compact fluorescents. But we need to educate. We need to take it one step further. And I think the utility has an opportunity to take a leadership role here in really explaining what can be done from the installation of that compact fluorescent lamp; workshops, for example, seminars, public outreach events, taking it to the public to really help them understand what can be done when you change that compact fluorescent or when you install that photovoltaic system up there.

Now the other big thing is we need to clear up the misconceptions. There's a lot of propaganda circulating out there, and at the end of the day, propaganda kills projects. We need to make sure that everybody understands the real economics, the real factors behind these energy projects, these green energy projects, to allow them to work. And ultimately, we need to get the public involved. So what kinds of things can the utility be doing, helping the consumers understand what we need, where we stand today, and what their effect can be from doing some green.

Now from an energy project developer's perspective, one of the most important things is your power purchase agreement. That is your contract with the utility to sell your power directly into the utility grid. This is an onerous process as it currently stands. Right now it's an 11-page non-utility generator followed by a 93-page Power Point on basically everything under the sun from an independent power producer's standpoint, and then you wait two years. It's a long process that challenges the energy project developer simply because a lot of times what we need to make projects work is the investment tax credit, the federal tax credits that help to offset the cost. Those tax credits are generally a year to two years out. When the NUG or the PPA takes two years to execute and the investment tax credit is up in a year, you really struggle to try and get your project financing together.

One of the things that we can do here to streamline this is to basically make it standardized. You know, help us understand exactly the steps and the time lines between that. I'm not necessarily saying make it shorter in time, but help us understand the true economics behind what it takes to get a PPA. So I'm suggesting the standardization or even a guide to a PPA, if you will, that gets out there to the energy project developer.

What else can utilities be doing? Well, a follow-up to the PPA is what's known as the standard -- the interconnection agreement; that is, tying your system into the utility grid. Generally speaking, when you do this, every time you do this, you have to reinvent the wheel, and that's a challenge. It's a cost factor, and it's a variable cost. You don't necessarily know where you stand, and you don't necessarily know a lot of factors as to how long it will take from the utility side to get back to you with regard to their work, and that's a challenge.

One of the things, again, we can do here is to standardized this process and come up with possibly some very simple metrics behind it. If you're installing a 50kw PV system, here is your standard interconnection agreement, and here's what you need to do. Here's exactly how much you're going -- it is going to cost you. And I'm not even suggesting it get that pinpointed. We could actually have more of a generalized standards. But I think a set of -- a standard system would be a really good next step in this, standardizing interconnection agreements.

Another thing that utilities out there are doing a lot of is they're investing in projects. They're actually putting their money where their mouth is. They're not just buying the green power. They're actually helping to build the green power project. A good example, as you see there, is a solar project that's been around for over 20 years in the California desert and generates 354 megawatts of power. That project is owned by Florida Power & Light. That utility is a very dirty utility. They burn a lot of coal and other things to generate their power. So now they're creating a renewable energy practice to help offset their dirty practices.

Another project that you see next to that is a wind farm, again owned by Florida Power & Light, and that power is sold to Austin Energy. And it's a relatively large system, 280 megawatts of power.

It's happening internationally as well. In Spain, four mega projects similar to that solar collector field you see there are going up for a gigawatt of power. That's a lot of power. And those projects are also owned by Spanish utilities. So these are things that are being done now.

Now Hawaiian Electric has a Renewable Hawai`i which helps to do that, but I've also circled from the website the last date that any kind of information has come out of them. It was back in March of 2005. So these are the kinds of things that could be done or continue to be done. Or if it not, let us know where you stand with things of this nature.

Also in investment and research, we need -- we understand that Hawai`i has a very unique grid. We have a different kind of a peak period than most utilities have across the country. We understand we have seasonality. We understand we're heavily based on tourism. So we need to know, the community needs to know what kinds of renewable energy systems work the best within the -- within the overall grid that we face here in Hawai`i.

So to kind of wrap it up, what I did very, very quickly was I went through a series of different utilities, and I wanted to find out what they were doing in green power. So I went to these utilities' sites, websites, and I typed in buying -- buy green power. I went after the investor-owned utilities because I wanted to see what the effect was of the utilities that were adopting green practices as it relates to their bottom line. And I went after the larger utilities. Dark green was they -- I found some very relevant information by doing this search. Kind of light green is somewhat relevant information by doing this search. And gray was not relevant by doing this search.

Pacific Gas & Electric, five -- and I took the top five search items that I found, five great things on renewable energy, five great things on doing education for the public, helping to green up the city. Oh, and by the way, five great green things also means revenue went up and profits went up.

Florida Power & Light, three green things, two somewhat green things, one not-so-green thing, somewhat self-promoting. But also revenues went up; profits went up.

Southern California Edison, five green things; revenues went up; profits went up.

Duke Energy, one of the dirtiest utilities in the country, five green things. Revenues went down, but profits went up by 2 percent. And when you're as large as Duke Energy, 2 percent of revenues going up are -- is multimillions of dollars. That's a lot of money.

And, of course, Hawaiian Electric, one green thing, one somewhat green thing, three not-so-green things. Revenues went down; profits went down. So I think there's a direct correlation between doing what's good and also what's green. And also, by the way, profits is green. So I think that there's some kind of a correlation to be found there.

So in summary, what can utilities be doing? Well, obviously, the first thing you should be doing is support energy efficiency, the low-hanging fruit. But then ultimately, support renewable energy by green programs. Support complementary renewable technologies. Educate the public as well as professionals. And ultimately, be transparent. Tell us what you really want. Don't say one thing -- and I'm not suggesting this is happening, but utilities have a tendency to do this. Just tell us what you want, and we can go out there and make it happen. You can empower us to make something happen, something good happen.

So I guess with that being said, I'll -- I'll wrap it up and turn it back to Terry.

THE MODERATOR: Okay. Thanks very much.

Okay. And again, my thanks to the court reporter. We'll give her a minute, and then we'll start taking some questions.

(Whereupon, a brief recess was taken.)

THE MODERATOR: By the way, before people start sneaking out, I'd like to give you all a round of applause for the majority of you staying here today, so thanks very much. And thanks again to HECO, to Mina Morita for hosting this event. I think it's incredibly useful.

INCORPORATING CLIMATE CHANGE INTO THE IRP PROCESS

Question and Answer Session

THE MODERATOR: Okay. The first question, to John Tantlinger: What is DBEDT recommending to the governor concerning HP 226? Sign? Veto? Let pass without her signature? That's the first of three, John, by the way.

DR. TANTLINGER: First of three?

THE MODERATOR: Questions.

DR. TANTLINGER: Repeat the question?

THE MODERATOR: Oh, you want me to repeat the question?

DR. TANTLINGER: No, no, no, no, no. I'm saying, are the three questions the same, whether DBEDT recommended the governor --

THE MODERATOR: I think -- no, no, no. You won't get off that easily.

DR. TANTLINGER: That's really a tough question, and I'll tell you why. Let me put it this way: I'm really not in a position to be able to answer that question, and I'm -- I have to be very honest. I mean, the comments and recommendation -- this is my understanding, and if I'm wrong, I will provide the information back to the folks who were here through HECO. But my understanding -- and maybe even someone in the audience who may know better than I, an attorney, for example, with the State. But my understanding is that the comment and recommendation sheets that are provided between the agencies and governor are considered working decision papers until such time as the decision is rendered. Now if I'm wrong -- and I'm getting a nod. So, unfortunately, I'm not in a position to answer that question. I'm staff. I'm not a policymaker. That is a policy question. And that's really not what I'm -- I'm here to respond to.

THE MODERATOR: So -- so in other words, the brief answer would have been, to quote Mongo from Blazing Saddles, that you were simply a pawn in the game of life.

DR. TANTLINGER: No, no, that's not what I'm saying.

THE MODERATOR: That -- okay. John, John --

DR. TANTLINGER: And I resent that type of characterization --

THE MODERATOR: No, hey, John --

DR. TANTLINGER: -- even though it's a feeble attempt at humor.

THE MODERATOR: Yeah, okay.

DR. TANTLINGER: And let me -- and I -- which I do respect because I love humor. And I got a laugh. Ha, ha. Okay.

Anyway, let me -- let me try and do it this way. I will say this: Throughout the legislative session DBEDT was very actively involved in providing testimony, participating in working groups regarding the various greenhouse gas bills. For those of you who have -- who have endured the entire day, I think you can see that DBEDT is committed to reducing greenhouse gas emissions and doing it in a way that is cost effective, that's equitable to the people of Hawai`i, that doesn't penalize us unfairly, that does it from a scientifically and very solid analytic base.

These are the kinds of suggestions that were made during the legislative session throughout it.

We believe, as I mentioned this morning, the estimates, for example, on our emissions -- these are the models that were developed to do that. The EPA itself, who developed those models, concedes they were never developed for regulatory purposes. Therefore, we suggested a lot more analysis needs to go into it. The current bill has in it a provision for a significant amount of analysis. We think that's very responsive to the testimony and comments that we've provided. We said that any effort like this needs to be adequately resourced. We actually suggested 1.1 million dollars over two years. I believe it's 500,000 per year, so a million over two years, for the first two years. And so that, I think, is responsive to the comments.

We believe that it's responsive inasmuch as it allows for some flexibility and does not immediately set a target and -- or rather, it does not immediately tie regulations to a definitive target before the analysis is done. And a very complicated and, I think, rigorous analysis is well outlined in that statute. So from that perspective I think you can tell that we believe that the current version of the bill responded in many ways to the testimony that DBEDT provided. But in addition, it did not respond to some of the other comments that we provided. So I think that sort of characterizes --

THE MODERATOR: Is there any decisions --

DR. TANTLINGER: -- our thoughts.

THE MODERATOR: Okay. Second part is, are there any decisions that have been made about who would be in charge of this, should it become law, within -- within DBEDT?

DR. TANTLINGER: Oh, that's easy. Oh, within DBEDT. Oh, I thought you meant who was gonna be in charge of it, 'cause that's in the law.

No. Well, yeah, wait a minute. What am I saying? It's in the law: the DBEDT director --

THE MODERATOR: Okay.

DR. TANTLINGER: -- of course, or his designee.

THE MODERATOR: Okay. Carl, will the IRP wait to specify mission reductions until the state mandate takes effect?

MR. FREEDMAN: Oh, I'd be guessing. I think what I was trying to say is that there's no mandate at this time. I was trying to also stress that the Commission has a great deal of discretion, and I'm not gonna guess where the Commission's gonna go or where the utility is gonna go.

THE MODERATOR: Okay. Carl, another one: Should -- did the IRP identify the operational economic trade-offs between greenhouse gases and other electrotechnologies such as ice storage which may not reduce greenhouse gases?

MR. FREEDMAN: I missed the first word. Should or?

THE MODERATOR: Should, yes. Should the IRP identify the operational economic trade-offs between greenhouse gases and electrotechnologies which may not reduce greenhouse gases?

MR. FREEDMAN: Okay. Well, I mean, "should," I'll go back to the IRP framework here. The intention and the requirement is that all resources that are feasible within the time frame of the analysis should be examined. And the extent to which you look at all those has to do with which objectives you identify. So if you're gonna identify the -- as one of your objectives, you know, greenhouse emissions, then you should be looking at all the different resource options. And this is up in the information, you know, characterization phase. You want to figure out for all potential resource options, how they're going to meet or address all of the objectives that are identified.

Now how specific do you get? You know, whether or not that type of analysis in IRP is gonna be -- provide valuable information to the task force is gonna be determined by, you know, the depth of the analysis we're looking at. And hopefully there's gonna be some iteration, I think, so that the task force and the utilities' efforts in whatever venue, you know, are helping each other and looking at each other.

THE MODERATOR: Okay. And this is for anyone. Any thoughts on utilities backing green energy with coal to produce stability?

DR. TANTLINGER: What?

THE MODERATOR: Well, I think the implication is if you're -- actually, I'm reading into the -- here's the question again, and I could offer some implication. Any thoughts on utilities backing green energy with coal to provide stability? Coal, C-O-A-L.

MR. KIMURA: I don't understand the question.

DR. TANTLINGER: Yes.

MR. FREEDMAN: I think the panel doesn't know how to answer that question.

THE MODERATOR: You're talking coal and, you know -- I think coal is -- the implication was that if you have green power possibly being intermittent, what do you -- what might you use for baseline?

DR. SURLES: Oh, I see.

THE MODERATOR: I'm -- I'm inferring, if somebody wants to try that.

MR. FREEDMAN: I mean, in any utility planning process you need to look at the system operations, and some green energy is intermittent. When photovoltaic -- some is base load in terms of biomass, use of fuels. So some types of intermittent resources need to be backed up. And if you're gonna use coal to do that, then you're going to be perhaps diversifying your portfolio by getting away from oil, but you're also going to be increasing your carbon-per-kilowatt hour in that quotient.

MR. KIMURA: Well, I'd like to take a stab at that as well.

You know, I think when we -- when you talk about -- in the description you made, coal would not be a good way to base-load or work against green energy. There are other technologies that you could integrate which have a lower carbon footprint than coal. Coal is one of the dirtiest fuels we have that we can burn to create power. So I wouldn't nec -- I would say to the question that -- kind of how you rephrased it, Terry, is that, no, that's not a good suggestion. There are other options out there. Also there are other kinds of renewable energy technologies.

And I kind of mentioned it in my presentation that when you take the right technologies and you puzzle them together, you actually can make this thing work. If you have a whole bunch of wind, that necessarily isn't the best way to go. But you match wind up again -- and depends upon the wind profile -- against certain types of other solar technologies, possibly with geothermal, and possibly with -- I'm getting the nod, the indication to slow down again -- with hydro, maybe now you have a workable system, so no -- no to coal.

THE MODERATOR: Okay. So Darren, since -- a question is to you. What prompted or prompts utilities to make real changes and go green? This is from your observations. What would you suggest Hawai`i can do to move our utilities to be more green?

MR. KIMURA: Well, at the end of the day, a lot of -- a lot of what happens here is -- is driven by economics. There's been a lot of talk at the federal level for a cap-and-trade system. A cap-and-trade system would essentially put a limit on the amount of emissions that entities like utilities can emit. And once they reach that level, they have to figure out a way to offset that. So it essentially enables market factors to play a role.

For example, in Europe now, if you're a dirty business, you could buy carbon offsets to basically offset your own dirty footprint. They're trading at about $30 a metric ton now. Now that ton will go back to somebody who's creating green power and -- and help incentivize their business.

So I guess what I'm saying is it has to be economic. This is -- a lot of the utilities in the United States are investor owned, so they have a board of directors and shareholders which they have to report to, dividends which they have to give out. So we have to figure out a way to economically incent them, whether it be on the state level, on the federal level, or any other possibility, if that's an adequate answer.

THE MODERATOR: Okay. Another one for Darren: Are -- are RECs, FITs, power purchase agreements, PPAs, et cetera -- and I put in quotes here -- Enronomics with green food coloring?

MR. KIMURA: Well, Enronomics, I'm not sure exactly what that is supposed to infer. But let me take a stab at it anyway. And that's actually a pretty deep question with power purchase agreements. And the reason -- the reason it's deep is some utilities unbundle them, meaning that you can sell power, and you have the ability to sell your green energy goodwill on the side. Some utilities put them together, and you cannot separate them, which -- which is a problem because you don't get the additional dollars or cents per kilowatt hour for that green aspect. In some states they are -- they do participate with things like the Chicago Climate Exchange which, in effect, removes some ability to do green tagging with in-lieu-of carbon trading. So, in other words, you can do one or the other. However, some other markets are now allowing both to occur.

So -- so with that very complicated, probably not very specific answer, I don't know. I think the market in itself is still being developed. The United States, as we are not part of Kyoto, we're very much independent. Each state has their own policy, and that in itself lends to some trouble with being able to sell green tags and having a fair market value for that or carbon certificates or whatever the case may be. Enronomics, I don't know.

THE MODERATOR: Okay. The next one's for John. And I'm having problems with the -- with the verb here. I can't seem to read it. But your presentation, I guess, mentioned ECAC as rate-sharing. However, it seems that ECAC shifts all the risk-taking into ratepayers. Isn't this counterproductive? It seems that because of ECAC, the utilities lack motivation to lower fuel costs.

DR. TANTLINGER: Yes. Yes. We agree. And that was the reason that the bill actually -- it began looking at requiring, actually requiring that you -- costs be shared by the utilities for fuel. And it was -- eventually evolved into a situation where it now requires the PUC to examine that, to study that, as I understand it. And now forgive me if I don't remember it exactly, but the point is, they are to develop a way in which the pass-through is not a complete pass-through, but, rather, develop other methods so that the risk is not borne strictly by the consumer for cost -- or fuel cost variability and increases.

THE MODERATOR: Okay. Thanks.

Carl, you speak of the PUC and the IRP process as the vehicle to realize House Bill 266 [sic]. Why do you see this as a PUC responsibility rather than one that is primarily or solely for Department of Health?

MR. FREEDMAN: Well, simply that I think that to the extent that any law or requirement affects the utilities, it's gonna come across the PUC's desk and will be reviewed by the Consumer Advocate. So if you're gonna require the utility -- let's say there's even a county law. You know, you could have a county law that would require different resources or something that might affect resource development. Anything that's mandatory, that the utility must do, is gonna affect the Integrated Resource Plans. So clearly, if the utilities are required by House Bill 226 to reduce greenhouse emissions, then this needs to be taken into account in the Integrated Resource Planning process, and it's gonna have some PUC review.

Now there's -- there is also the upstream potential there that the PUC, you know, could on its own say, hey, we have HB 226 coming down the pike. As an interim measure let's have the utilities roll their own emissions -- you know, come up with some plans that roll their own emissions back to 1990's to -- either as an investigation of what it's gonna cost or put together some plans in anticipation of what might be coming down. But basically the PUC oversees all aspects of utility planning. So anything that's gonna affect their plans is gonna come across the PUC desk.

THE MODERATOR: Okay. Thanks. And if -- that was the last question, so if we could have -- oh, Carl.

MR. FREEDMAN: I was just gonna offer a comment that Darren might say, you know, at the end of the day, you really have to say it's the end of the day.

THE MODERATOR: Thanks very much guys.

And now before I turn it over to Gary Hashiro, I -- first of all, once again, I'd like to thank the audience and that there are forms to provide comments to Hawaiian Electric on today's meeting, and they're available out at the registration table. So with that, Robbie was unable to come back, so here's Gary Hashiro.

CLOSING REMARKS

MR. HASHIRO: Hi there. There was a lot of tremendous information provided today by all the speakers. And more importantly, the information is specific to Hawai`i and our unique situation here. For that, I'd like to thank all of the speakers today. Would you join me in thanking them?

You know, it would be a terrible shame if at the end of today when we all go home that this information, this wonderful information, sort of fell by the wayside. And to help us not have that happen, today we have our wonderful court reporter who managed to hang in there throughout the entire day. Let's give her a round of applause.

And I see quite a few of our advisory group members for the Integrated Resource Planning process. This is the group of folks that advise the utility on how to do our long-range planning. I'd like to thank you for hanging in there throughout today.

And last, but not least, I'd like to thank you, the audience, who with your questions have greatly increased the information exchange today. So on behalf of Hawaiian Electric, thank you very much.

I'd like to close by just sort of, What next? What next here is we're gonna take this information that we received today, and we're gonna work with our advisory group members in updating our long-range resource plan over the next coming months, and that will ultimately be filed with the Public Utilities Commission for their approval. You may see all of the presentation material that's provided to us. We'll put it up on our website, along with the transcripts for today. And the website is on the handout on the last page, as well as an e-mail address if you have any further comments you'd like to submit to us regarding today's meeting.

With that, aloha, and thank you all for coming today.

(Whereupon, at 4:12 p.m., the hearing was concluded.)

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STATE OF HAWAI`I)
) SS.
CITY AND COUNTY OF HONOLULU)

I, Valerie Mariano Swiderski, C.S.R., a Notary Public in and for the State of Hawai`i, do hereby certify:

That on Friday, June 8, 2007, at 8:34 a.m., the foregoing proceedings were had before me; that the proceedings were taken in computerized machine shorthand by me and were thereafter reduced to print under my supervision; that the foregoing represents, to the best of my ability, a correct transcript of the proceedings had in the foregoing matter.

Dated:

Valerie Mariano Swiderski, C.S.R. #353
Certified Shorthand Reporter
State of Hawai`i