MEETING

STATE OF CALIFORNIA

AIR RESOURCES BOARD

JOE SERNA, JR. BUILDING

CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY

SIERRA HEARING ROOM, SECOND FLOOR

1001 I STREET

SACRAMENTO, CALIFORNIA

WEDNESDAY, APRIL 21, 2010

1:11 P.M.

LINDA KAY RIGEL, CSR
CERTIFIED SHORTHAND REPORTER
LICENSE NUMBER 13196

APPEARANCES

BOARD MEMBERS

Ms. Mary Nichols, Chairperson

Dr. John R. Balmes

Mr. Ron Roberts

Dr. Daniel Sperling

Dr. John Telles

STAFF

Mr. James Goldstene, Executive Officer

Ms. Lori Andreoni, Board Clerk

Mr. David Kennedy, Staff, Program Development Section, Office of Climate Change

Dr. Kevin Kennedy, Assistant Executive Officer, Office of Climate Change

Mr. David Kennedy, Program Development Section, Office of Climate Change

ALSO PRESENT

Dr. Paul Bernstein, Charles River Associates

Dr. David Roland-Holst, University of California, Berkeley

Mr. Tom Tanton, T2 & Associates

Mr. Reid Harvey, U.S. Environmental Protection Agency

Professor Larry Goulder, Stanford University

APPEARANCES - continued

Dr. Chris Busch, Center for Resource Solutions

Professor Michael Hanemann, University of California, Berkeley

Professor Hal Nelson, Claremont Graduate School

Dr. Hal Nelson, Claremont Graduate School

Mr. Jim Lazar, Burbank Water and Power

Mr. Norman Pedersen, Southern California Public Power Authority

Mr. Obadiah Bartholomy, Sacramento Municipal Utility District

Mr. Hank Ryan, Small Business California

Ms. Dorothy Rothrock, California Manufacturers & Technology Association

Mr. Ray Williams, Pacific Gas & Electric

Mr. Hank DeCarbonel, California Concrete Pumpers

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P R O C E E D I N G S

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CHAIRPERSON NICHOLS: Good afternoon, ladies and gentlemen. There are plenty of seats in the front for those who are standing in the back.

This is the Air Resources Board April 21st, 2010, public meeting. So I'm now officially calling us to order.

Before we begin, we will say the Pledge of Allegiance to the flag, so please rise.

(Thereupon the Pledge of Allegiance was recited in unison.)

CHAIRPERSON NICHOLS: All right. Will the clerk please call the roll.

BOARD CLERK ANDREONI: Dr. Balmes?

Ms. Berg?

Ms. D'Adamo?

Ms. Kennard?

Mayor Loveridge?

Mrs. Riordan?

Supervisor Roberts?

BOARD MEMBER ROBERTS: Here.

BOARD CLERK ANDREONI: Professor Sperling?

BOARD MEMBER SPERLING: Here.

BOARD CLERK ANDREONI: Dr. Telles?

BOARD MEMBER TELLES: Present.

BOARD CLERK ANDREONI: Supervisor Yeager?

Chairman Nichols?

CHAIRPERSON NICHOLS: Here. Thank you.

We have made arrangements for this program to be webcast. I know at least one of our Board Members is watching it in real-time, and others will be either reading the transcript which is going to be available from the court reporter or watching the recording of the proceeding afterwards. There is great interest on everyone's part in this particular topic.

I have a couple of announcements to make before we get started that are logistical.

The room has emergency exits as you can see in the rear and to the side here. In the event of a fire alarm, we are required to evacuate this room immediately and go down the stairs and out of the building until there's an all-clear signal given. Then we can return to the room and resume the hearing.

For those of you who are not regulars at ARB meetings or in this building, there are restrooms on this floor located down at the end of the hall.

And then with respect to participation in this because this is a somewhat unusual set-up for an ARB meeting, the way we're planning to do this is to have a

rather lengthy set of presentations and discussion by invited panelists who are here to reflect a number of different points of view and to give us information about different aspects of the economic assessment of the impacts of the AB 32 Scoping Plan.

Then there will be opportunities for those in the audience who wish to ask questions or make comments to participate. Rather than having everybody parade up to the microphone initially, we're going to be passing out cards.

Does anybody have cards to show what these things look like? Yes. Here they are. That's a comment card. We will be putting them out and passing them around and then sorting them and trying to make sure they're distributed to the people for whom they are intended.

This will then be followed by further enlarged panel discussion, and then finally by a general open comment period where anybody who wishes to make a comment of the traditional formal public comment can do so.

We have this scheduled, this whole proceeding, for four and a half hours. We also have scheduled a break after the first panel so that people can get up, stretch, et cetera.

So with that, I'd like to say just a little bit more about why we're here.

This item is an update to the Board on the revised AB 32 economic analysis. It's continued from last month's Board meeting in order to allow both Board Members and stakeholders more time to review the staff report.

As you may recall, the staff report was released quite soon before the -- quite close in time to the last Board meeting. And rather than force people to respond at that time, we decided to give additional time.

I also want to make it clear this is not an action item. It's an opportunity for Board Members to hear from staff and other experts about their analysis; and so we've invited a number of people to come and talk about related parallel economic studies which don't always reach exactly the same conclusions and to try to understand the differences and the usefulness of the various types of studies.

The ARB directed its staff to work with experts as they developed their own staff analysis. And I know that the ARB staff worked closely with the Economic and Allocation Advisory Committee and specifically with its Subcommittee on Economic Impacts during the course of

developing their own revised assessment.

We are expecting Professor Goulder who chaired that committee to join us. He was teaching today and was going to have to be a little bit late but he'll be getting here as soon as he can.

This Board also directed the staff to look for opportunities for collaborative modeling efforts as they went about updating the analysis after the original Scoping Plan was released and adopted in 2008.

Two of the presentations this afternoon, the ones from Paul Bernstein of Charles River Associates and from David Roland-Holst of UC Berkeley, are a result of that collaboration.

They I think provide some useful insight into how results can shift when you use different modeling tools, although you may have the same set of inputs and assumptions that you're using to exercise those models.

With that, and given the Board's interest, we thought it would be illuminating to have a discussion with all of these analysts and also to talk about possible future analyses and research needs.

So although the principal goal here is to complete our review of the most recent economic assessment, we are also I think expecting to have some discussion about some additional kinds of research that

could and should be done.

So I'm looking forward to a very robust conversation.

Board Members are -- and we are joined at the table here by our Executive Officer, James Goldstene. We will take advantage of the opportunity to break in and ask questions if we can't wait, but we will also just be enjoying watching this dialogue proceeding.

So with that, I want to thank all of the members of the advisory committee and especially those on the Economic Impact Subcommittee who contributed so much of their time and expertise to this endeavor.

I also want to thank the panelists who have graciously agreed to be here today and to share their results with us and to contribute to the dialogue.

With that, I will turn this over to Kevin Kennedy, the Director of the Office of Climate Change, and he will begin the introduction of the panelists the pang.

DR. KEVIN KENNEDY: Thank you very much, Chairman Nichols.

I would also like to add my thanks to the panel members, both the ones sitting here at the table at the moment with me and the panelists who will be joining us when we get to the second session of the afternoon.

We felt that it was a very important thing to do in terms of the economic analysis that we had done for AB 32 to help everyone, the Board Members and the public, put the work that we did into a broader context in terms of what we found, what others have found, in trying to analyze the economic effects of this sort of action on climate change.

For that reason, we invited a number of people for this first panel to talk about recent analysis that's been done, either of AB 32 implementing the Scoping Plan itself, or action that is being contemplated at the federal level.

I will be moderating this first panel. The speakers will be David Kennedy from the Office of Climate Change who we heard a little bit from last month.

Paul Bernstein from Charles River Associates who we also heard a little bit from last month.

David Roland-Holst from UC Berkeley.

And as Chairman Nichols mentioned, both the work that David Roland-Holst released last week and Paul Bernstein's Charles River Associates work that was released in March were a result of collaboration where we were working to have a common set of inputs and assumptions used between our analysis and other modeling

tools to be able to better understand the importance of the different modeling tools as well as different inputs and assumptions.

We also will have Tom Tanton from T2 & Associates to talk about some analysis that he conducted for the AB 32 Implementation Group.

And we're pleased to have Reid Harvey from the US EPA who will be talking about analysis that's been done of the federal proposals.

So that will be the first panel.

And what we will do from there after we take a short break, the idea for those presentations will be to give a fairly quick and high-level summary of what analysis was done and what the results were.

I should also mention that one of the other analyses that has been talked about a lot that has also both been used by some to criticize AB 32 but also has been in for its own criticism as well, was conducted by Varshney and Associates.

We did invite Sanjay Varshney and Dennis Tootelian to participate in the proceedings this afternoon, but they were unable to participate. They indicated they had other engagements they were not able to get out of.

So the first panel will be presenting the basic

results of recent analyses.

We then invited a number of economists from around the state to have some degree of comments on the different analyses that have been conducted to be able ask questions and discuss the analysis amongst themselves and with the first panel.

And that session will be moderated by Professor Larry Goulder. It will also include Hal Nelson, Michael Hanemann, and Chris Bush, and we'll have a bit more introduction of those panelists when we get to the second panel.

For that panel, we did also invite the Legislative Analyst Office to participate if they were interested, and they, after some consideration, decided they were -- they felt it was more appropriate for them to listen and learn from the proceedings today rather than sort of take direct part.

But we're very pleased to have Tiffany Roberts from Legislative Analyst Office here to sort of listen and learn along with us as to sort of the implications of the sort of analyses that we are doing.

The third session after the discussion with those panelists will be taking the initial comments and questions that folks in the audience will have the opportunity. We'll be distributing the cards shortly

for people to write out comments and questions to direct to either set of panelists.

Once the second panel comes up, we'll have ten people sitting around the table so questions could be going to pretty much anybody or relatively broadly. So there will be some additional discussion and comment through that portion.

And then of course we will have the opportunity for folks who are interested to have sort of more typical public comments of getting up and speaking at the microphone.

And we'll have a separate set of cards that will be distributed for that a little bit later after people have had a chance to have a flavor for the discussion up to that point.

So with that, I would like to turn it over to David Kennedy who is the main economist who was working on the economic analysis, the updated economic analysis of the Scoping Plan for the Air Resources Board.

DR. DAVID KENNEDY: Thank you, Kevin, and good afternoon, Chairman Nichols, and Members of the Board. I will provide a brief summary of what was presented at last month's Board meeting.

Next slide.

So first of all, what was new in this updated

analysis. The updated ARB analysis includes a new Business-as-Usual projection that reflects the recent economic downturn.

We include as part of the Business-as-Usual scenario the impacts of the Pavley 1 regulation and the full implementation of a 20 percent renewable portfolio standard.

The analysis uses a dual modeling approach that includes the Energy 2020 model and the E-DRAM model. The two models which have different strengths are meant to act as complements and provide alternative views of the potential effects of AB 32 policies.

The report analyzes five cases to show the economic impacts of making different policy choices such as getting fewer reductions from complementary measures and eliminating offsets entirely.

Next slide.

ARB relied on two modeling tools to perform this analysis. The first one, Energy 2020, is a multisector energy analysis system that simulates the supply, price, and demand for all fuels.

This version of the model was developed for use by ARB by ICF International and Systematic Solutions, Incorporated.

The second model was the E-DRAM model. E-DRAM

is a computable general equilibrium model of the California economy originally developed by Peter Berck in collaboration with California Department of Finance and ARB.

Next slide.

The original Scoping Plan analysis estimated the effects of implementing all Scoping Plan measures. This analysis takes a different approach by focusing on several key complementary measures.

These include increased energy efficiency programs and standards, a 33 percent renewable energy standard, increased use of combined heat and power, a regional VMT target, California clean car standards, goods movement measures, and the Low Carbon Fuel Standard, and a Cap and Trade program.

Some of these measures are implemented in the modeling in a detailed manner while some are implemented in less detail.

Specifically, there are some important issues that could affect the cost of the Cap and Trade program that warrant further examination.

Next slide.

In this analysis, we present the results for five cases that we do discuss some variations on these cases in the report.

In the first case, Case 1, we assumed that all complementary policy goals are achieved in full, and we allow the use of offsets in the Cap and Trade program.

In Case 2, as in Case 1, all complementary policy goals are achieved in full, but offsets are not allowed.

In Case 3, there are fewer reductions from the transportation measures.

In Case 4, there are fewer reductions from the electricity and natural gas measures.

And in Case 5, we include a combination of Case 3 and Case 4.

So in these sensitivities, we basically assume that the complementary policies achieve half of their targets, with the exceptions being the 33 percent renewable standard and the VMT measure where that policy is excluded completely from the analysis.

In all cases, the Cap and Trade program provides the remainder of the reductions needed to achieve the AB 32 target.

Next slide.

Our assumptions about economic growth are that gross state product would grow on average at about 2.4 percent per year or 36 percent from 2007 to 2020.

Personal income would also grow at a rate of

2.4 percent per year, and employment would grow at a rate of about .1 percent per year, or 13 percent over the 2007-to-2020 period.

Next slide.

In terms of economic effects, the change in gross state product ranges from about positive .2 -- minus .2 percent to minus 1.4 percent across the five cases.

The change in personal income ranges from .1 percent to minus .6 percent.

Excuse me. The change in personal income ranges from .1 percent to minus 1.2 percent, while income per capita ranges from .1 percent to minus .6 percent.

And the change in labor demand or employment ranges from .1 percent to minus 1.7 percent.

And across the five cases, the 2020 allowance price ranged anywhere from $21 to $102 in 2020.

Thank you very much.

CHAIRPERSON NICHOLS: And again, because this always seems to come up, the percentages are off of a projected rate of growth that would have occurred regardless in 2020.

DR. DAVID KENNEDY: That is correct.

CHAIRPERSON NICHOLS: Okay.

DR. KEVIN KENNEDY: Thank you, David.

Next up is Paul Bernstein from Charles Rivers Associates in order to provide an overview of their analysis released in March.

DR. BERNSTEIN: Thank you very much for inviting us here, and thank you very much for inviting us in this entire process.

I'd also like to thank Michael Gibbs from Cal/EPA for all his help as well as the ARB in this collaborative effort that I will describe here.

Next slide.

Okay. As mentioned, this has been a collaborative effort with the ARB, and so I'd like to start out by sharing some of the common themes that we found with the ARB as well as some of the differences in the two modeling results.

First, we find that in running the set of ARB scenarios, these cases that David just mentioned, cases 1 through 5 as well as some other cases we looked at, we see a range of impacts.

We see the allowance prices ranging from $50 to $80 per ton of CO2 in 2020, and this is roughly 50 cents to 80 cents per gallon of gas.

We see the costs in terms of a per capita cost ranging from $200 to $500, and that equates to about a

half a percent to 1.1 percent loss in per capita income.

We do find when we look at Case 5 that our results are fairly similar to those of the ARB. The ARB finds costs per capita of about $270, and we find costs of about $290.

Also, as the ARB, we find that offsets afford great benefits. They both reduce the overall costs of complying with the program as well as reducing the permit price associated with the Cap and Trade program.

We find a reduction in permit prices of about 33 percent whereas the ARB finds a reduction of about 80 percent.

One area where there is a fairly big difference in the models is what we find about the inclusion or exclusion of complementary measures when added into a Cap and Trade program.

So we find that these complementary measures restrict choices or reduce flexibility and therefore increase the costs of complying with the AB 32 target, whereas the ARB finds that adding in these complementary measures most likely corrects some market failures and therefore end up reducing costs when they're layered onto a Cap and Trade program.

I'd like to clarify, I think, one point of confusion that may be out there. Both ARB and CRA

account for the cost savings in any energy reductions, so any energy efficiency that takes place is accounted for in CRA's model.

And both sets of models also find that sensitivity to things such as economic forecasts, technology assumptions, and the like.

Specifically, we ran a number of sensitivities where we looked at what we felt were more likely costs for the alternative fuels that would be needed under the Low Carbon Fuel Standard.

And when incorporating the costs that we feel are more likely, we find that the overall program costs -- that's not just the LCFS, but the overall costs of complying with AB 32 -- increases by 40 percent.

We also find that the overall cost estimates are very sensitive to the emissions forecast. So if one were to use the emissions forecast that was in the 2008 Scoping Plan, namely IEPR 2007, as opposed to the current forecast, the IEPR 2009, the costs are significantly higher under the IEPR 2007 forecast.

Next slide.

Okay. So I'd like to compare results. The next few slides will be fairly similar in terms of the figure here.

So what the figure has is on the Y axis we see

the permit price that would result in the Cap and Trade program. And on the X axis, we have the overall program costs, the cumulative program costs from 2010 to 2020.

And throughout these slides, we'll compare different scenarios.

The first one is showing the benefits that we find of removing the complementary measures from the program.

So the diamond to the right there labeled SP is ARB's Case 1. So that's the full Scoping Plan with all the complementary measures.

The upper square there is the Cap and Trade program that achieves the same amount of emission reductions as in the Scoping Plan policy but has none of the complementary measures.

So you can see moving from the Scoping Plan that includes all the complementary measures to a program that has none of the complementary measures, you reduce the costs by about 50 percent.

Now you'll notice that the carbon price increases when we remove these complementary measures.

Essentially, what we find in our model what that's saying, it's a representation of how much the complementary measures are distorting the Cap and Trade market.

So in an undistorted or unconstrained case with just the Cap and Trade, the permit price would be about $30 higher.

And these distortions are exactly what lead to this cost difference between these two policies, between the Scoping Plan and then a policy that's just a pure Cap and Trade.

Next slide.

BOARD MEMBER SPERLING: Could I interrupt for a moment? You know, all this discussion of all this aggregation kind of confuses me.

When you keep referring to complementary measures, are you including LCF -- the Low Current Fuel Standard? Are you including the VMT?

What are you -- what are you counting as complementary measures?

DR. BERNSTEIN: Yes to all of that. So if -- on David's slide, he had -- it's the fourth slide here. It's basically -- we're including -- when I'm talking complementary measures, I'm including all of those.

So the 33 percent RES, the VMT measure, the LCFS, Pavley II, the energy efficiency measures, and the CHP measure.

BOARD MEMBER SPERLING: Okay. Well, this might be kind of a methodological issue or a language issue,

but, you know, the VMT measures, for instance, are not what you call command and control in any way whatsoever.

There is -- there are performance targets -- they're not even performance. They're targets given to metropolitan areas through SB 375 is the major way they're going to be met, so there is complete flexibility for metropolitan areas how they meet it.

Likewise, with a Low Current Fuel Standard, it's a -- it creates a market. They're tradable credits.

So these -- both of these don't resemble in any way whatsoever what, you know, someone might call command and control and in fact, you know, have quite a bit -- have a huge amount of flexibility associated with it.

So I'm going to come back at the end, you know, and ask you how you can come up with these calculations when in fact these measures have a lot of flexibility in them when you compare them to supposedly flexible Cap and Trade.

Unless you have some, you know, initial response to that.

DR. BERNSTEIN: I agree that you've built in -- or there are flexibility mechanisms built in to, let's say, LCFS just like the RES has flexibility in it. But

it still constrains the market more than if you had a pure Cap and Trade.

BOARD MEMBER SPERLING: Sure. Or if you had a carbon tax.

DR. BERNSTEIN: Right. Either one. I mean either way, it's still offering -- it's offering -- or it's putting a distortion on the market compared to having, as you said, a Cap and Trade or a pure carbon tax.

This slide is showing the benefits of including offsets or the -- or the losses or the additional costs if you were to exclude offsets.

So again, the diamond is representing the Case 1, the Scoping Plan with all the complementary measures.

And the upper circle there is Case 2, which is the Scoping Plan and excluding offsets.

The lower circle is the Scoping Plan. So again, includes all the complementary measures, but now we include a much larger amount of offsets.

So you can see that if you took from one extreme of the no offsets down to more offsets, you have the potential of reducing the program costs by about a third and also greatly reducing the permit price which would reduce or lessen the incentives for investment to leave California.

All this is contingent also on having a well-designed offset program, so under such a program we'd obtain the same overall global emission reductions as we would without the offsets.

Next slide.

Here we're showing the sensitivity to assumptions about technologies or technological costs, and this gets back to the LCFS is one of the main drivers of this increase in costs here.

So again, the diamond is the Scoping Plan with all the complementary measures.

The triangle is the Scoping Plan, again with the complementary measures, but we're working under an alternative set of cost assumptions for the low carbon fuels.

So the Scoping Plan there is using the ARB's cost assumptions which essentially assume that the alternative transportation fuels are about 10 to 20 percent more expensive than the conventional fuels we have now, the gasoline and diesel; whereas the alternative measure is assuming that the cost of these fuels are more around two and a half times what the conventional fuels would be.

And under that assumption, we see that the costs increase by more than 50 percent.

One thing that is not on this slide that we have in one of our supporting slides is this gap or this percentage increase shrinks a lot if you compare a policy that we're just a pure Cap and Trade with the low cost assumptions to a pure Cap and Trade with these higher cost assumptions.

And that's basically because in the Cap and Trade, again, you're not restricting the market in terms of where it needs to get its emission reductions.

So when you don't do that, if you -- if higher technology costs come about in one particular area, so let's say the transportation sector, if you allow the policy to have freedom in where it can get its emission reductions, then technology increases in just that sector have less of an impact on overall program costs.

Next slide.

And I'm sure I'm short on time, so why don't I skip this slide. This is just a summary of the last three slides.

Okay. Finally, let me just conclude here. I would say that, instead of reading all of these, that our main message is that flexibility is very important in the policy.

We find that flexibility in terms of having flexibility by removing or excluding or reducing the

complementary measures saves costs.

Flexibility in having offsets reduces costs.

We also say for whatever complementary measures are put in place we would say that flexibility is important.

And the last bullet has to do with any linking of a federal policy. We find that if California were to simply be a part of Waxman-Markey and do away -- or not be under AB 32, that the cost to California would be far less, and the global emission reductions would be similar.

Thank you.

DR. KEVIN KENNEDY: Thank you, Paul.

Our next speaker is David Roland-Holst from UC Berkeley who will be providing an overview of results of another of the collaborative efforts that we had. And his results were just published last week, so it will be new to a lot of you.

Thank you. Go ahead, David.

DR. ROLAND-HOLST: Thank you, Kevin.

I just want to ask, is there a remote for the slides? Do you have a remote? No. Okay. I'm going to have to step you through some components then.

Thank you again, Kevin. Thanks to the Board for this kind invitation, and thanks to all of you for

your interest in a relatively momentous policy issue for California.

I am an independent academic, and this work is being done independently.

Next slide, please.

There's an e-mail address on the first slide if you have questions you'd like to address to me, but without going through all the acknowledgements, I want to heartily thank my colleagues at Cal/EPA for their support in providing data and consultation.

This is an independent exercise, and it was funded by nonpartisan, nonprofit NGOs which have basically the same objectives as I do --

Next slide.

-- as an independent researcher. My three objectives are to do this estimation as an analytical exercise but to -- mainly to inform stakeholders and approve visibility for policymakers and especially to help to support rigorous standards for evidence-based policy and policy dialogue particularly in a very complex issue like this one.

Next slide, please.

This is just to summarize the overall findings that my team has come up with in our parallel exercise.

First of all, we find that the aggregate direct

effects of AB 32 on the California economy are negligible, more positive when they're not negligible.

Secondly, innovation responses could leverage climate policy for a very significant growth dividend.

Thirdly, participation in a national climate program will increase benefits for California by reducing adjustment costs and providing greater growth opportunities from innovation.

Fourth, individual sector demand output and employment can change very significantly. There will be significant adjustment issues that ensue from this policy at the individual sector level.

And we also, last of all, find no significant leakage in our assessment.

Next slide, please.

Here is how we do the -- maybe you should just step through all these components.

Basically there are four pieces to the BEAR model, the Berkeley Energy and Resources model, that's been around since the legislative debate began on AB 32. We did some early assessments; in fact, the results were quoted in the Executive Order that established AB 32.

But this is the basic structure. I don't need to go through the technicalities. The model is completely documented online, and more details are

available to those who want to send me an e-mail.

The policy horizon that we are looking at now is 2010 to 2020, but the model goes out to 2050 for more extensive analysis.

Next slide, please.

Just maybe step through all of these. This is a breakdown of all the components. It's far too prolix to go through -- one more -- to go through now but that's sort of the anatomy of the model facility.

Next slide, please.

One thing I want to highlight in our contribution which is different from the others that might be of special interest is we really do try to say something about the role of innovation.

It is the hallmark of California's superior growth experience. Knowledge-intensive industries have made remarkable contributions to California's living standards, and we don't want to omit this from consideration in a technology-related policy such as climate policy.

It's particularly the case with energy efficiency improvements, and I have a historical study that I did which is published separately showing that California's electricity standards and its appliance standards, its home building standards, and its

regulatory standards led to savings of -- actually the CC estimated $56 billion in savings, and I translated that into job creation and got an estimate of about 1.4 million additional jobs over a 30-year period as a result of energy efficiency measures.

To give an indication of the innovation potential, we added -- we did one scenario where we added a little bit to energy efficiency over the assumptions of the five cases that our colleague suggested to us, and the effects of that are, I think, quite illuminating.

Next slide, please.

This is why energy efficiency pays off in the economy. This is the California economy divided into 114 separate sectors, and those sectors are ordered by job intensity, employment intensity.

As you can see, there's tremendous diversity across the economy in terms of job creation potential.

Next step, please.

The basic message of this slide is that the carbon fuel supply chain is among the least employment intensive in the economy.

Next step.

If you look down here at carbon fuels, they are the lowest in terms of job content, employment content,

by a long shot. I want to remind you that the vertical axis, the job intensity axis, is logarithmic.

Next step, please.

And you'll see that in the service sectors and the more typical consumer spending sectors, job creation rates per million dollars of revenue are 20 to 50 times higher than they are in the carbon fuel supply chain.

Next step.

If you can divert expenditure from carbon fuel supplies, if you can save households a dollar on conventional energy resources, and they redirect that dollar to their more customary spending habits -- namely services, right; 67 percent of GDP comes from giving each other haircuts and espresso drinks, service sector -- the job creation effects can be very substantial. That's expenditure shifting.

Next step.

And that's basically what we see in the energy efficiency scenario.

Next slide.

Evidence of this is very clear thanks to the patron saint of energy efficiency, Arthur Rosenfeld, who's given us this data.

Since 19 -- the early 1970s, California departed from the national trend through efficiency

standards and other measures and is now 40 percent below the national average, and that's where these savings come from.

Next slide, please.

The effect of this on innovation I think is something that we really need to emphasize because assuming there will be no innovation response to climate policy is, to me, shocking when you look at the capacity of this economy to innovate in response to economic incentives.

Here's the story for a very conventional appliance. These are refrigerators. Standards came into force somewhere during the '70s, and the effect was very dramatic on energy use per unit of refrigerators.

The effect on capacity was negligible, but actually you could say that it was positive. I won't make a causal link between those.

But it was very dramatic improvements in efficiency, and at the same time falling prices. Falling prices. This is the virtuous cycle of innovation that California knows very well.

The so-called Moore's law in semi-conductors seems to apply to other standards.

This is refrigerator technology. This isn't technology that was given to us by aliens. We invented

this ourselves in response to standards and policies. It didn't come from nowhere. It's actually an incentive-based response.

Next slide, please.

Okay. The California climate program, I've talked about this, but in a national context that -- actually Paul spoke about it.

In a national setting, California is at a slight disadvantage because of its past successes. The marginal cost of pollution abatement is much higher in California, so it's cheaper for us in a national program to buy abatement elsewhere, at least part of our abatement.

And we can save money by participating in a national program. So that's the essence of that finding.

Next, please.

To assess this, I actually was involved in another project, and we have separate model, national model, called the eagle model. We like animals in our shop.

The eagle model is a national climate model which itemizes every one of the 50 states individually. And we looked at the Waxman-Markey bill for a national environmental NGO, and we came to conclusions which I'll

talk very briefly about.

Next slide, please.

That model is fully documented if you are interested in national policies.

Here are the scenarios, and the first five scenarios have already been covered. Actually, the first six have been covered. The first five are the same as the ones that our colleagues at Cal/EPA have done.

This is the same as the one that was done by CRA where we assume that -- we exclude complementary measures and use only Cap and Trade as the instrument to achieve a climate objective.

Then there are two additional ones. The first one adds an extra four tenths of a percent to annual energy efficiency in California out to 2020. This is a very modest increase.

The reason this number was chosen is when I looked at AB 32 package, I calculated that it would yield about 1.1 percent improvements on average per year over the period to 2020.

California for 30 years has averaged a rate of 1.5 percent. So I simply added in the difference, assuming that California could extend the 30-year trend of energy efficiency improvements, particularly in

response to much more determined climate policy measures.

So this is where that number of .4 percent extra efficiency comes from.

And finally, the Waxman-Markey scenario is the same as the one we did at the national level, essentially reporting the results of the national analysis for California.

Next slide, please.

Okay. These are our findings. And to cut to the chase, our findings are very similar to those of our colleagues at CARB.

In terms of actual magnitude, there's really very little to talk about for the first five scenarios. We're all in the same relative magnitudes in terms of permit prices, income per capita effects, et cetera. They're all quite comparable.

I think those differences can be what you might call gentlemanly differences. That is, they don't represent any fundamental disagreement between our approaches.

There are some methodological differences in the models, but they don't seem to be yielding substantial differences.

If you look at the ARB cap, that is the cap

only policy, we get -- they are the largest adjustment costs. We put the entire burden on the caps.

This would be, I think, consistent with CARB's approach but inconsistent with the CRA approach because the CRA approach finds there are costs to the complementary measures.

We find the opposite.

Next, if we look at energy efficiency, we see that energy efficiency can confer significant benefits. I've already talked about the mechanism by which that takes place, so I won't elaborate too much. This essentially reverses cost.

Then finally, the Waxman-Markey approach. We find smaller but not insignificant gains -- well, they are maybe negligible gains. Let's be honest. But there are nonnegative effects here.

And permit prices are prices coming out of a national Cap and Trade system, but we get essentially a nonnegative impact from participation in a national program.

Next slide, please.

Okay. So what sources of bias might we find in these results? If you don't mind I'll just summarize those quickly, and maybe I'll answer questions by doing that.

First of all, I think the assumptions regarding initial conditions, especially with respect to market failures are a fundamental difference between approaches, and I'm very happy to elaborate on our approach to this issue.

Secondly, no foregone damages have been considered in this model, meaning that we don't look at the effects of the policy or offsets, things like that, on local pollution or public health effects, cost of doing nothing.

Finally, the treatment of innovation potential. As far as I know, our contribution is the only one that's approaching that issue now; and yet when you look at California's economic history, I think that's a relatively serious omission.

Next please.

Conclusion. These are essentially a restatement.

The macroeconomic impact of AB 32 will be negligible unless California climate action triggers innovation response which is a potent catalyst for growth in the state.

By creating a market to incubate the next generation of energy use and emissions control technologies, California can capture national and global

growth opportunities.

Last slide, please.

I haven't been asked for recommendations. May I cover this slide? Okay, thank you.

These are just kind of a synthesis of my perspectives on what might be most useful going forward.

First of all, I think a more extensive analysis of program design characteristics -- that is, the permit allocation system, a rigorous, detailed, evidence-based analysis.

Incentive properties. I think it's extremely important we look more carefully at incentive properties of these policies.

Welfare impact. We can go a long way to anticipate those.

And multiplier effects, a more inconclusive approach to understanding the benefits of these policies and not so much the specific direct impact focus, but a more inclusive focus.

Secondly, I think a more intensive analysis of the market and technology responses would be very welcome. And I know that technology community in California is really eager to participate in that kind of discussion.

And finally, I would personally strongly

recommend peer review of any research that's supporting substantive policy decisions. Decisions of this momentous character I think really merit a rigorous review of the evidence that's used to support them.

Thank you very much.

EXECUTIVE OFFICER GOLDSTENE: I have a quick question. You referred to Moore's law, and I thought it might be helpful if you explained that in more detail.

DR. ROLAND-HOLST: Thank you.

EXECUTIVE OFFICER GOLDSTENE: Microprocessor speed.

DR. ROLAND-HOLST: That's right, yeah.

EXECUTIVE OFFICER GOLDSTENE: You identified refrigerators, but there were other examples.

DR. ROLAND-HOLST: That's right.

Well, Moore was -- he was one of the founders of the Intel Corporation. And he coined essentially a folkloric -- a folk rule which was that the speed of processors would double every 18 months. I think -- was that it? I think that -- that's it, yeah.

So this is just a rule of thumb about the very rapid rate of innovation.

I think that many people in the technology sector in California are hopeful that that type of innovation and process, sort of learning by doing,

accelerating improvements, rather than the traditional diminishing returns perspective, is something that will apply to knowledge-intensive industries.

And let me remind you -- many people are not aware of this, but energy by review is the world's largest industry.

And energy efficiency can be to that industry what IT is to management around the world, what biotech is to medicine. It can revolutionize traditional practices around the world.

And that's why the venture community is determined -- they are so eager to put a price on carbon, to create a market in the world's eighth largest economy which can incubate these kind of technologies.

Thank you.

DR. KEVIN KENNEDY: Thank you, David.

The next speaker will be Tom Tanton from T2 & Associates in order to provide an overview of some analysis that he released in March.

Go ahead, Tom.

MR. TANTON: Thank you, Kevin, and thank you Chair Nichols and the Board for this opportunity.

I've done a reconnaissance level analysis of the recommended by EAAC Cap and Trade program under an auction.

My analysis differs from those that you have heard about today and last March in the sense that I didn't look at the entirety of the Scoping Plan but just the Cap and Trade recommendation.

I also didn't compare the different allocation mechanisms but only looked at the cost under a 100 percent option.

I looked at four critical aspects of that Cap and Trade recommendation. They are listed on the chart.

Next slide.

I basically took data and mechanisms from the EAAC report of March 15th, and later in my presentation I'll describe some responses to Dr. Gould's remarks at the last Board meeting in March that I was unable to attend.

Next slide.

The summary results are a little hard to read on the screen, but they are available in the handouts.

The results, as would be expected, are varied dependent on the auction clearing price. That's no surprise to anybody, but it has implications, I think, for the Board and others that I'll get into later.

A range of costs for a typical family of four is anywhere from 270 to over $9,300 a year depending on that clearing price and the year the auction takes

place.

Since nobody can really forecast what the auction prices are going to be, I assumed a range basically, again, from the EAAC documented range.

And again, the inability to forecast that market clearing price has significant impact on how the CARB treats the various economic analyses.

We did not assume any particular price. And based on the premise of uninformed prior, we assumed that the price would be flat throughout the forecast period. We know it won't be.

We also know from other markets that it's likely to be highly volatile from year to year or from quarter to quarter, depending upon the timing of the auctions that take place.

There are some potential mechanisms that can moderate that price volatility, but in terms of making investments in new facilities in California, be it low carbon fuel distribution facilities or whatever, that price volatility will significantly impact the investment decisions made by firms and others.

A few examples of the price or the cost that different entities might experience. This is not just energy firms. This is private and public institutions.

UCLA at $20 a ton would have to pay three and a

half million dollars per year to stay in operation. That's over a hundred freshman students.

It's not just low tech firms.

Biotech firms, one of, you know, California's preeminent growth markets, would also see significant cost implications.

And even the renewable technologies, or at least some of the renewable technologies, when calculated correctly, would also experience significant cost increases.

The geothermal power plants have a significant component called noncondensable gases which includes carbon dioxide primarily, and unless they're in a binary cycle, that's a significant cost impact to them and will affect the success of the renewable electricity standard.

Again, I did not evaluate complementary measures as part of the Scoping Plan. I just looked at the cost to different types of firms under the Cap and Trade.

There's also significant uncertainty on how the auction proceeds might be redistributed or reused in the economy.

To the extent that revenue is captured in a special fund under the control of CARB, the Legislature

would face some significant budgetary constraints. This is a significant concern, primarily from the standpoint that it's a bunch of money. You know, we're talking in eight years of the auction collecting over 120 percent of a single year's state budget in total aggregate amount.

The EAAC did suggest some mechanisms for that which may or may not be successful. It does lead, I think, to an increased significance or concern about leakage, not just the reuse of the revenues.

Consumers may in fact spend their rebate on cheaper products from out of the state, so it exacerbates the potential for leakage.

We use a very simple and, to use Kevin's earlier remarks, high-level input/output model extracted and collapsed from Bureau of Economic Affairs, data set from 2006.

It does not iterate on final demand. It assumes demand is comparable. And it further assumes that in the region of equilibrium, whether you go negative or positive, the curves are essentially symmetrical and essentially the same in magnitude, albeit different in sign.

We didn't calculate or iterate on final demand because many of the models assume older elasticities.

And as Dr. Sperling published about two years ago with his colleagues, gasoline -- a significant component of all this modeling -- gasoline elasticity has dropped significantly and dropped by about a factor of 10, as I recall.

It's important to note that imports to the California market from other states and other nations show up significantly and represent the bulk of the drop in state GDP and the overall cost in employment.

I do agree with Dr. Roland-Holst that service sector employment would likely increase and reduce our carbon intensity and add jobs; but at the same time, that's more of a wealth transfer and less of a wealth creation from manufacturing and high-tech.

We also compared our initial estimates to prorated estimates --

Next slide, please. Thank you.

-- under taken by both private and public entities looking at Lieberman-Warner, simply because those analyses had been completed.

These numbers are a bit higher than they would be under Waxman-Markey. Mostly analysis of Waxman-Markey assumed more in the trading cost of $20 a ton where Lieberman-Warner was assumed to be about $50 a ton.

The proration was done simply by the fact that California represents 13 percent of the national GDP, so we took 13 percent of the overall cost to the national economy.

If California goes alone, these costs would be higher. Again, this right-hand column.

Next slide.

At the March portion of this event, Dr. Goulder made some initial comments regarding my study and why it differed from some others, and I would like to briefly respond.

I didn't assume fuel substitutions or technological change, but I didn't assume that would not happen either.

The problem becomes whether those are attributable to the Cap and Trade program. They may occur naturally. And I'll give you two examples where mandates and subsidies have acted counterproductive to innovation.

The first example I'll use is Denmark, which we're often told to look toward for how we should be doing things. But in fact, over the last three years, their labor productivity has dropped and become worse than it is now -- or worse than it was then.

And I take labor productivity as a fundamental

measure of innovation. I drive a tractor on my farm because I can get more work done. My labor productivity on the farm is enhanced because I drive a tractor rather than using a shovel.

I could create a lot of jobs by giving everybody a shovel, but that doesn't improve the overall wealth creation.

I also make a comment on the renewable portfolio standard not just here in California but elsewhere. Combined with the PTC, we've seen the price of various renewables skyrocket largely as a result of the demand for those pieces of equipment to become overheated.

Wind turbines, for example, have gone from about $1,600 a kilowatt hour -- excuse me -- a kilowatt installed five years ago to well over $2200 a kilowatt today.

That's a result of overheated demand for turbines, if you can get them, driven in large part by the RPS in the various states and the PTC.

The EAAC report also suggests a wide range of uncertainty in clearing prices at auction. I think it's fair to say that nobody can accurately forecast what those prices are going to be ex ante.

In other auctions, prices have skyrocketed, but

they've also plummeted. Reclaimed experienced high volatility. The Europe Union's market also experienced high volatility. And recently the price completely fell out of the market -- fell out of the bottom of the market.

And plummeting prices lead to devaluing permits that have been issued or banked. If I buy a permit today for $100, and next year when I was expecting to use it it's worth $5, the State has now created a stranded asset in that permit.

Next slide.

Dr. Goulder also suggested that much of the discussion in my report erroneously equates allowance value with cost. I'm not sure which parts of that he's referring to; but in order to determine the value, we have to determine the marginal benefit from the action.

In the EAAC report, there's a lot of discussion about the cost to California from climate change. Well, that's a good discussion to have.

But we also need to recognize what are the benefits? What change in climate trajectories will occur from California's actions? And I would assert that it's very little.

But unless we do an avoided-damage calculation, we cannot establish the consumer side of that value

proposition.

We will have determined through the auction the supplier side of that equation; but keep in mind, with all due respect, Board, we have a monopoly market. And it's a constrained monopoly market.

As Dr. Roland-Holst indicated, California's already less carbon intensive than most other locales, either in terms of carbon per GDP, GSP, carbon in terms of labor, carbon in terms of capital.

What we should be doing is designing our program to export our technology, our knowledge, our techniques, and our behaviors elsewhere, not to be importing goods and services from those other locales.

That leakage is perhaps the most significant element of all of the economic analyses that have either been given short shrift or ignored completely.

I also did not compare pre-allocation to the auction approach.

I'm going to take the liberty here of making a recommendation or suggestion.

There's been a lot of discussion over the last two years about which economic analysis is right. We have a lot of parties weighing in: Mine's right. His is right. LAOs commenting on the different things. Members of the Legislature are as well. It's a big

issue.

I would recommend that ARB stop the dueling models. It's not of benefit. Use it as a design tool. Use all of them as a design tool rather than as a quote justification tool.

And I'll give you an example from, in my mind, recent history -- for others, long ago history -- and that was the run-up to the electricity deregulation.

At the time, I was at the California Energy Commission. And one of the responsibilities of the California Energy Commission is to do forecasts. So they forecast the energy supply.

How much electricity are we going to have? Well, we're going to have a surplus. Ergo, let's go with a second price auction.

They put in place no contingencies for what happens if there is not a surplus. In fact, we found ourselves in that precise situation.

Had they in place a contingency fallback of you get paid what you bid, we would have taken a $30 billion problem and turned it into a $3 billion problem.

That's one example of where the analysis overwhelms the rational behavior and the rational decisions that you all need to make.

We want to export our technology and

manufacturing and services. We don't want to import. And let's use these things, all these analyses -- you can use mine or not -- but take from them design tools, not justification tools.

CHAIRPERSON NICHOLS: I really think that is a useful recommendation, and I think it will be discussed further. I want to ask you to wrap up at this stage just because I know we've got a lot of other people who want to speak, and we're a little short Tom.

MR. TANTON: I was ready to wrap up, and thank you for the encouragement.

CHAIRPERSON NICHOLS: Okay. That's great. Appreciate it.

DR. KEVIN KENNEDY: Thank you, Tom.

So our next speaker and final speaker on this panel is Reid Harvey from the US Environmental Protection Agency, shifting the discussion from evaluations of California's Scoping Plan to proposals for action at the federal level.

Reid?

MR. HARVEY: Thank you, Kevin, and thank you to Members of the Board for inviting me. Thank you for inviting me today. I'm pleased to be here with you.

Just as introduction, I'm Chief of Climate Economics Branch, the EPA's Climate Change Division

which is located within EPA's air office.

So in this last 12 months, EPA and other parts of the administration have analyzed a wide range of climate bills pending in Congress.

We have done at least four separate analyses in the last twelve months, two for the House Energy and Commerce Committee, one for the Senate Environment and Public Works Committee, and most recently in January an analysis of the House-passed Waxman-Markey bill for Senator George Voinovich of Ohio.

All of these are available on EPA's website.

The analyses that we've done are not just EPA's analyses. They represent sort of the combined work of a number of federal agencies, and they represent a significant amount of review by other senior economists, National Economic Counsel, Counsel of Economic Advisors, Office of Management and Budget, Department of Energy, Department of Agriculture and others.

So we're doing this sort of on behalf of that collective.

So in the ten minutes I have, I'll try to touch on some of the models that we've used. I'll try to discuss their limitations. I'll touch on one of the results, one of the GDP results that we've come up with, and then briefly compare what we've done to AB 32 while

acknowledging that I've not gone through in detail all of the analyses that you all have done which have been very impressive.

In summary, I think there -- my sense is there are a number of commonalities between the work we've done at the federal level and the work that you've done here in California.

We've both applied several different models, both sort of bottom-up, technology-rich models as well as top-down economy-wide models, and that has the advantage of capturing some of the technology implications of these policies as well as their broader effects on GDP and household incomes and so on. And so that's a valuable aspect.

In terms of the results, I think there are also some commonalities in that our analyses at the federal level and here in California appear to show relatively modest effects on household consumption.

Speaking to our results, for example, in our latest analysis of the House-passed bill for Senator Voinovich analyzing the Waxman-Markey bill, we looked at the impacts on US consumers in terms of changes in household consumption.

If you look at the long-term targets in the Waxman-Markey bill, we found that there was a slight

decline in the average annual household consumption by about $74 to $117 per year relative to a no policy case.

And on a percentage basis, that represents about .1 to .15 percent of 2010 household consumption, so relatively modest.

I'm going to turn to slide two now.

These are slides I took from an existing presentation, so they weren't really meant to be used in a public setting, more meant to be read, but I'll briefly use this as a way to describe the two major economy-wide models that we have used.

The first is called I-G-E-M, IGEM. It's a computable general equilibrium model developed by Dale Jorgenson of Harvard. It's primarily a US model. It's driven by econometric data at relatively fluid capital movement.

And it's an inter-temporally optimizing model, and it looks over the whole period from 2012 to 2050 to find kind of the optimal outcomes.

And we've also used a second model which has a different style and provides some richness to our analysis. This is also a CGE model. It's run for us by Martin Ross out of RTI.

It's a global model as opposed to a domestic model. It has stickier capital so it has some capital

adjustment costs compared to the IGEM model, and so therefore you have some lag in capital changes.

The other thing that we've done, and I think that you've done some of this as well, is applied a suite of other models to try to shed some light on some of the policy features of these issues.

So we've worked with analysts at the Department of Energy using their GCAM model to look at global energy and offset demand.

We've used a power sector model called IPM to look more specifically at the renewable energy standards.

We've used some specific models looking at forest and ag sector offsets, both in the US and globally using a global timber model.

And also looked at some of the advantages of reducing non-CO2 greenhouse gases using marginal abatement costs for those models.

Next slide.

This slide depicts some of the limitations. I've described a few of the differences between the models. I think you've done some analysis on employment that we have in our models, full employment models, for example.

So this is more, again, for you to read than

for me to walk through.

If we can go to the next slide, please.

In a quick look at what you've done versus what we've done, I think there's a lot of similarities.

Some difference are we looked at nuclear power and carbon capture and sequestration, and I think, as I understood it, you didn't in your work.

We used relatively similar assumptions about banking over time. I think the Congressional Budget Office looked at sort of a four percent rate, and the Energy Information Administration used a seven percent rate. I think you're in that range. We used a five percent rate.

The underlying policies that we analyzed were obviously different with respect to offsets in Waxman-Markey versus AB 32.

And one thing that we did that I think you didn't was look in more detail about different ways of allowance allocation.

Next slide, please.

So turning to results.

As I mentioned earlier, if you look at the aggregate effects on GDP and household income, our finding was that they are relatively modest over the timeframe that we analyzed.

This is a fairly busy slide, but just to try to simplify it for you, we looked at the growth of US GDP in the reference cases without any climate policy. That's the left-most bar as you're looking in that scale over time.

And then using these two models, ADAGE and IGEM, we looked at the effects on GDP as a result of climate policy.

And you can see from the relative heights of the bars that there's a relatively small difference.

And putting this another way, it would mean that you would, by implementing the Waxman-Markey bill, it's really equivalent to delaying reaching the same GDP levels in 2030 by a range of two to five months.

So that's -- again, it's a change from an overall growth rate.

Next slide, please.

We also used the Innovative Planning Model, IPM, to look specifically at electric power issues.

This is a very busy slide. I'm not going to go through it with you.

It's just to illustrate that we did look at some of the complementary policies at the national level to try to understand the interrelationship of the Cap and Trade program and RES.

We found that the RES targets would be met through 2015 in the no policy case, but by 2020 it started to take effect in that the RES did drive more renewables by 2025 than in the Cap and Trade case alone.

Next slide, please.

One thing that we didn't do in our analysis for Congress was to look at the benefits of taking action on climate change, but I want -- I did want -- I sort of would be remiss to talk about the costs without talking about the benefits.

So I wanted to point to some recent work that was in the present annual report of the -- economic report of the Council of Economic Advisors suggesting there's substantial economic benefits from avoiding damages from climate change, and I encourage you to look at that as well.

And then last slide.

All of these analyses are available in exhaustive detail on our website, and I'd be happy to answer questions.

CHAIRPERSON NICHOLS: I guess I have a generic question. Maybe it should be saved until the end. But the kind of mail that I get on a regular basis, some of it is polite, and some of it not so polite.

But here's a very, very polite one from the

board of supervisors of Inyo County, a rural, mostly desert county in California, asking me and our Board to review information related to AB 32 with a critical eye because of their concerns on the effects to their small county where population is small and disperse, and median income is low relative to other portions of the state, and to basically either reassure them that everything is going to be fine or, you know, do something to put a stop to this.

Now, there is nothing that I can tease out of what I've heard from your presentation or any of the other presentations that directly answers the questions and concerns that these people have at the local level.

Although I happen to know from my own experience that Inyo is a place that has some opportunities for development of renewable energy, for example, which would certainly be a form of jobs, I'm not quite sure what else is in the Inyo County, but they might have some energy-intensive mineral, for example, companies that are going to be, at least short-term, adversely affected.

What can we say to an ordinary intelligent supervisor from a county like this that would help them decide whether this is an issue that they should be paying attention to, and if so, how?

I mean that's really the bottom line here.

MR. TANTON: Chairman Nichols, if I could make a suggestion --

CHAIRPERSON NICHOLS: Mm-hmm.

MR. TANTON: -- as to the type of things I was referring to earlier with respect to use the economic analysis as design tools.

Since we know the cost, particularly on low income communities, is highly dependent on the clearing price within the Cap and Trade auction, why not consider various price collars or price caps for those permits?

If we see extreme volatility, allow for forward and futures market in those permits rather than having to buy a permit and then bank it for a future. Buy a future option on that permit.

So there's some techniques that can be used to at least mitigate --

CHAIRPERSON NICHOLS: I think that's --

MR. TANTON: -- you know, the cost impacts.

CHAIRPERSON NICHOLS: I --

MR. TANTON: I would recommend not doing it by a 100 percent auction.

CHAIRPERSON NICHOLS: If that was the -- that would at least be a tool that one could use.

DR. ROLAND-HOLST: Thank you, Chair Nichols.

I do support the idea of experimenting or at least looking at arbitrage mechanisms. I think that's a good idea, and that fits into the recommendation I made about more intensive analysis of these mechanisms.

But I would also add, although I don't want to sound self-promoting, that there is a county level version of BEAR on the drawing boards for each of the state's 58 counties, but we're trying to find support to complete that project.

So having said that, the state has an extraordinarily diverse economy, and I think it's very risky to draw conclusions from statewide averages when stakeholders are really thinking about very diverse adjustment challenges.

CHAIRPERSON NICHOLS: Thank you. Any other thoughts about this? Okay.

Thank you.

DR. KEVIN KENNEDY: Any other questions from the Board before we move on to the next part of the day?

BOARD MEMBER TELLES: I have a question. Couple questions.

It seemed that Mr. Taton's address was a lot more pessimistic than the rest of everybody else's address, and it seemed to be based upon estimation of uncertainty here in these analyses.

And was the same level of uncertainty looked at in the other people who did their analyses? Or -- I think there is a lot of uncertainty here and --

MR. TANTON: There is a tremendous amount of uncertainty. And that also tells us something.

One is to separate the manageable from the unmanageable risks or to turn one type of risk into another.

As I just mentioned, one way to manage the currently unmanageable risk of price volatility is through some sort of arbitrage mechanisms.

I would rather that the economic analysis be done using something similar to a Monte Carlo analysis since they all have hundreds and hundreds of little, you know, matrix boxes that have some number in them.

You can do sensitivity analysis based on those numbers, but why not put a probability distribution in it and run a Monte Carlo simulation?

That also tells you something very significant. Is there a probability of a highly consequential fat tail? Well, if so, then let's pay attention in the design phase of that highly consequential fat tail.

But you have to complement that analysis with a better analysis of the marginal benefits from California reducing its emissions while everybody else continues

unabated or, worse, selling stuff to us at their higher energy intensities.

So, you know, I'm a California-born native son. I have to be optimistic. It's in my genes.

But doing the analysis, there are warning signs that crop up. So they're intended as warning signs, not as a pessimistic forecast.

BOARD MEMBER TELLES: I have one more question here related to uncertainty.

This will probably go into the first question too because to me, just being a citizen of California, the biggest uncertainty here is: Will our products be more expensive than the rest of the world's, especially if the rest of the world doesn't play the game, if China and India doesn't play the game or the rest of the United States doesn't play the game?

It seems to me that the simple thing is that California products would be a lot more less competitive in the world market.

And in that regard, when you did these analyses, did you estimate in the growth of the economy what the effect would be if China and India doesn't play the climate change scenario and if the United States doesn't do it?

Because to me, it seems that if you don't put

that into your estimates that it would be very difficult to say where the California economy is going to be.

You have to add three other scenarios. In other words, I'm talking about China, India and the United States. It seems like the California economy is dependent on what happens in the rest of the world too.

MR. TANTON: Well, I think you're absolutely correct. And China/India behavior is one element of a fully robust economic analysis of what we do here in California.

It's not just a question of whether California products are higher priced. But more importantly is what is the value proposition?

As Dr. Roland-Holst indicated, our technology provides generally better performance, more convenience, whatever it happens to be.

So the price may be higher, but if the value proposition is such that others clamor for our technologies, we can do with a higher price. You know. Just like Nordstrom's beats out Macy's sometimes. Higher price, better performance.

I'll give you an example from the Low Carbon Fuel Standard which I have yet to see quantified in any of the economic analysis.

The low carbon fuel has less Btus in it. So me

as an individual consumer, I have to fill up more frequently. What is the dollar value of my lost time from having to fill up more frequently?

That's part of the value proposition, even if it's not reflected in the price.

The problem is that's only two examples of things that need to be in the analyses which are in some and not in others; but by the time you do it right, it's too late.

There's no way to get all of the factors that will have some impact. And what we're doing is we're losing sight of accuracy and design guidance at the expense of precision.

I would rather we focus on --

DR. KEVIN KENNEDY: Tom, I'd like to allow some of the other panelists to have a chance to speak.

CHAIRPERSON NICHOLS: I actually was hoping that the one entity that would have looked at international competitiveness would be the US government and --

MR. HARVEY: Right.

CHAIRPERSON NICHOLS: -- perhaps you would have something.

MR. HARVEY: I was going to respond to that portion of your question.

The administration did look at this question about the effects of climate policy on trade exposed energy intensive firms.

So the National Economic Counsel, the CEA, EPA, the Commerce Department, the International Trade Commission and others did some modeling that we published in December of 2009 that looked at this question, and we looked at the provisions that are in the Waxman-Markey bill that address this concern.

We found that the allocation scheme in Waxman-Markey works substantially to alleviate the concerns about trade leakage from those factors. It provided substantial free allocations to those firms that met certain criteria with respect either to energy intensity and trade exposure.

So I think our finding was that those sorts of provisions can go a long way to addressing that concern that you raised.

BOARD MEMBER SPERLING: I'd like to just jump in for a second on this issue.

You know, people repeat this -- let me bring it, you know, all these economic models are, you know, are good and useful and this issue of trade exposure is an important one.

I just came back from China a couple days ago.

It's extraordinary the investment they are making in efficiency, in solar technologies and wind technologies. You just see these technologies everywhere, far more common than we see, even in California.

So, you know, it really makes me cringe, even angry, when I keep hearing, you know, what's going to happen to California?

I think, if anything, as Dr. Roland-Holst was talking about, this is -- there's huge opportunities, and I think that's what, you know, we all --

CHAIRPERSON NICHOLS: Opportunities not to lose, in the competitiveness war.

BOARD MEMBER SPERLING: Yeah. And I would support that suggestion that we look more closely at how this innovation process works because, you know, we do have the record in California of information technology investments through Silicon Valley, the biotech, you know and even some of the programs that ARB has run.

Like even with emission control on vehicles, when you do a cost analysis and you see the effect of the performance standards, there's been tremendous innovation effects.

Just an example, we now spend more -- we spend less money per car on emission control technology than we did 20 years ago, even though our emissions are a

fraction of what they were.

And we haven't done a good job of that and the economic models don't capture that very well. I would like to kind of repeat that theme here that, you know, I think that's something that either within ARB or -- and maybe motivate others to look at this.

Because it is, you know, the -- even though all the models seem to agree, that kind of scares me a little, actually, these economic models that, you know, in terms of the impact because I suspect on the positive side there could be, you know, the positive effects could be very significant, especially for California which is very innovative in its technology, in its industries, and its markets.

CHAIRPERSON NICHOLS: Don't go away folks. We have more economists, more presentations, more studies.

(Laughter)

CHAIRPERSON NICHOLS: But we're going to take a 15-minute break. And during that break, I would like to ask the staff to distribute cards to anyone who is going to want to actually engage in this conversation in the next hour or two.

And they're going to wave them around here. Put down as succinctly as you can what the topic is that you want to talk about.

Okay. We're going to take a 15-minute break.

(Recess)

CHAIRPERSON NICHOLS: Okay. We're going to resume here.

We've now been joined by Dr. Larry Goulder from Stanford who has been the tireless, tireless chair of the Economic and Allocation Advisory Committee. And we have also got several other people here to speak.

Again as a reminder, the cards that were handed out and I guess will continue to be available are for comments that will be organized and given to the panelists. It is not for an open mic kind of session at this point. That will come at the very end.

And we want to now introduce the second panel. And this will be further discussion but more focused on the review and the critique of recent economic studies as well as implications for future analysis and action.

And so I'll turn it over to Professor Goulder.

PROFESSOR GOULDER: Thank you very much, Chair Nichols.

It's a pleasure to be here. I very much appreciate the fact that the Air Resources Board has put together this meeting.

Already in the first panel, we've seen a lot of ideas come out. Some of them are similar. Some

diverge.

I think the underlying question we're all asking is what should we conclude about the impacts of AB 32, whether it's the overall impacts or, as mentioned, the impacts at the local level for a particular household, particular industries.

So this follow-up panel, the second panel, is trying to pull things together. We certainly won't be able to get rid of all the uncertainty, but we hope to be able to shed light on the issues, where the models differ, why they differ, perhaps narrow the range of uncertainties and move us closer to similar views as to the impacts of AB 32.

So we're going to expand and consolidate, hopefully, a lot of the ideas that came out in the first session.

I mean there was discussion about the complementary policies that Paul Bernstein mentioned being very important in terms of explaining differences in result.

Board Member Dan Sperling emphasized -- had some views about that as well.

Another issue that came up this morning -- excuse me -- earlier this afternoon was the leakage issue.

Board Member Telles mentioned he was concerned about competition with the rest of the world, and Tom Tanton as well as Reid Harvey had things to say about that.

There's also the important issue of technological change or technological innovation. David Roland-Holst was especially emphatic about how significant a role that could be.

So how do these different issues get analyzed in the models? Where do the models do well? Where do they not? And what can we glean from this? What's the signal behind all the noise?

So our panelists are three. We have Chris Busch, who is Policy Director of the nonprofit Center for Resource Solutions.

Michael Hanemann immediately to my right is the Chancellor's Professor as well as Professor of the Department of Agricultural and Resource Economics at UC Berkeley.

And we also have -- where is he? There he is. Hal Nelson, Professor at the School of Politics and Economics at Claremont Graduate University.

So here's the format which we're going to be using. We're going to start off each panelist in I guess alphabetical order will have 10 to 12 minutes to

comment on the first panel, the modeling work. They can ask questions of the modelers if they want. Also if they want they can engage in some back-and-forth discussion with the modelers.

So that's in the first -- will take us the first half hour, first 35 minutes.

Then I'd like to follow up with perhaps ten minutes for my own comments and conduct some Q&A with the panelists and the modelers.

And then we'd like to reserve a lot of time, perhaps the last 20 minutes, to field questions and engage in discussion with the Board Members, although I imagine some of that 20 minutes will happen in the first hour as well.

So we want to at least have a lot of time for interaction. I think that will be most informative to everyone who is here.

So let's start right away. I'm going to start -- again, do this in alphabetical order. So Chris, you're on. If you can take 10 or 12 minutes to comment on the first panel and engage in discussion if you like.

DR. BUSCH: Thank you, Larry. I'll try to provide some comparative comments.

And let me start by thanking you for volunteering so much of your time on behalf of the

State. It's been incredibly useful.

I also think this collaborative modeling effort that CARB initiated was a great idea, and I think it narrowed some of the differences.

Let me highlight a conclusion from the EAAC modeling subcommittee. And that is that, despite significant differences in model assumptions, both analyses -- this is referring to the CRA and the CARB work. David Roland-Holst's work wasn't out at the time, but I think it applies to his work as well.

The analyses reached conclusions that the net impact of AB 32 on California is going to be very small. In the absence of AB 32, the growth is forecast to be 2.4 percent. In the CRA results, the annual growth rate is about 2.3. And for CARB, the annual growth rate is the same at about 2.4 percent.

And let me just say why I think this makes intuitive sense. We're embarking on a significant endeavor, but it's really a very gradual change over a ten-year time period.

Even though the State has done a lot, as Jim McMahon, the head of energy efficiency technologies division at LBNL likes to say, energy efficiency is a renewable resource.

And CARB in their detailed policy analysis

outside of the macro work has found a lot of additional opportunities for energy efficiency savings.

And then also the expenditure shifting that David so eloquently described.

On method, let me just highlight the addition of the energy 2020 model to the CARB arsenal, so to speak, I think is a great addition, adding technology-specific detail to the work that goes I think beyond best practice.

For example, the work at Cal/EPA doesn't integrate that sort of technology-specific detail with their CGE work, and so I think that is a mark of sophistication. And the CRA work, as well, also has that sort of detail.

I think in thinking about some of the reasons that the CRA work comes out with higher costs, the level of detail is, in terms of sectoral disaggregation, is much smaller so they have ten sectors of the economy whereas in the CARB work and David Roland-Holst's work there's over a hundred.

So by lumping things together, you basically obscure opportunities for low-cost abatement.

On this issue of the extent of market failures, I agree with things that Larry has said that there's a need for more empirical work in terms of describing

where these market failures exist that are the basis for government policies that can boost the economy.

And it could be that my father is a psychologist, but I see a lot of irrationality out there in the world.

I think more concretely at this time of economic difficulties brought on by lack of regulation an ideological position that government can't create economic benefits seems difficult to maintain.

The EAAC included a very useful table summarizing different aspects of the modeling that could bias cost upwards or downwards.

I think some of the areas that are importantly left out are the innovation areas that David mentioned, and this -- basically, we're assuming current technology at current costs, even though we know with emerging technologies that costs will come down and that new options will enter the realm of possibilities.

And costs come down for these emerging technologies because of learning by doing and economies of scale.

So we -- so this is not well-captured by the models except for in David's innovation scenario.

Also, energy security is another area that is of interest and is not factored in.

So the models basically assume a smooth price path, but as we've seen, for example, in 2008 where we had a spike gas prices, you know, there are these unexpected events that create economic costs.

And of course there's the issue of the climate benefits not being included.

And so in my view, these are studies more really of costs, even though they are generally interpreted as cost-benefit measures.

Let me say a little bit about green jobs.

There was a new report from the California Economic Development Department showing 500,000 jobs in -- green jobs in California to date, 93,000 of these in manufacturing, more than any other sector.

So this is an increasingly well-established area of work.

On the other hand, we have these seeds of new companies, what Dan Kammen has called the billion dollar companies of the future, and what the macro models are not good at capturing is sort of the potential for these economies to grow and dominate in the global marketplace.

I wanted to say a little bit about some of the timing issues that have been in interest in trying to better understand the short-term impacts of AB 32, and

let me say a little bit about that, first reasons to expect costs would be low.

There are very small reductions at the start of the program. Actually, the first year cap is intended to be set at Business-as-Usual taking into account other policies, so not large reductions.

And the amount of offsets allowed is relatively large compared to the amount of reductions at the beginning of the program.

In their assessment, the LAO pointed to investment requirements as a reason to expect there might be job losses in the short-term. Now, I don't think that's right for a couple reasons.

First we see innovative financing options such as on bill financing, property assessed clean energy, making these investments possible even with capital constraints.

Also our current economic downturn is really insufficient demand is the problem. So investment is another -- could be another form of stimulus in a macroeconomic sense.

Looking at the research needs going forward, I don't think that these macroeconomic models are good for optimizing the mix of effort between Cap and Trade and other policies. Notice, for example, the US EPA has

analyzed complementary policies through other models.

So it would just be too expensive and time-consuming to try to do that. That said, as each of these regulatory measures moves forward, they're going to have to be subject to a stand-alone economic analysis; and in those proceedings, I would urge more attention to characterizing the market failures that are intended to be overcome, also push to recognize the broader social benefits and costs that would ideally be considered.

Attention is given to what is quantified and monetized, and if we do not -- if we don't do that, if we don't monetize these things, we're going to inevitably ignore them.

Also going forward, we're going to need to pay attention to some of the distributional questions that need to be grappled with, and analysis can inform that debate.

On Mr. Tanton's study, I didn't find it well enough documented to say too much about it. I thought that Larry Goulder's assessments were fair in terms of not allowing for substitution away from dirtier fuels in response to carbon price in terms of conflating allowance value with compliance costs which sort of seems to assume when you sell a permit you just throw

the money away, and I don't think that's what going to happen.

Couple of concluding thoughts.

We have talked about costs and benefits and trying to assess those. I think I would point out that climate damages are what are known as a fat tail distribution, and basically cost-benefit analyses sort of ignore the extremes of the probability distribution.

And economists such as Harvard's Martin Weitzman have argued that an insurance frame is really the right way to think about this policy.

And what this research is suggesting to me is that AB 32 is at worst a close to zero cost insurance policy against catastrophic climate disruptions with the payoff being a better world.

Lastly, Harvard -- former Harvard President Bok put out a book recently that I would suggest should inform our attention to these issues of macroeconomic growth, and here's what he says. He said:

> To oppose policies in the name of growth gives economic expansion a preferred position in the hierarchy of national priorities that seems hard to justify when doubt exists over whether it does much, if anything, to promote the

well-being of the American people.

Thank you.

PROFESSOR GOULDER: Thank you, Chris.

Now we'll turn to Michael Hanemann. And again, if you would like to engage the modelers during your talk, you may.

DR. HANEMANN: I have a brief PowerPoint.

Let me say I greatly appreciate the opportunity to attend this meeting. And as Chris stated, I think the EAAC has done an extremely valuable job both in general over the last two or three years but also the report that just came out as an appendix.

My background is that throughout my career, going back when I was a graduate student 40 years ago, I've been a consumer of models.

I haven't been a builder like Larry or David Roland-Holst or some of the others, but I have used models like the ones here in various aspects for the US and elsewhere looking at energy policy, water policy, other aspects of development policy.

And so -- I also of course have taught modeling. So I'm going to rely on some of my experiences in dealing with models.

And also in the early years, in 2005 and 2006, with my greatly missed colleague, Alex Farrell, Alex and

I worked with David Roland-Holst in the economic modeling in the building of the BEAR model, and we were certainly apprised of issues that associated with modeling.

I want to talk --

Next slide.

-- about three topics, issues with the specific models that have been talked about today, some issues that arise with models generally, and then just a little bit about the actual experience with Cap and Trade so far.

Next slide.

In terms of the models, there are three major issues that are at stake with greenhouse gas reduction which determine how costly this is going to be to the economy.

One is the extent to which you have types of market failure. You have people not doing things not because it would be more expensive than it's worth to do the thing, but for other reasons they choose not to take certain actions. And essentially they could take actions and have no cost or have some gain. There is the principal agent problem known to economists.

With some things you don't have a market intermediary. I will only invest if I have a very high

discount rate. There are other people in the economy who would make those investments with a much lower discount rate, but nobody can bring me and them together in such a way that there'd be gains from trade.

And then there's abundant evidence from behavioral economics that people have limited choices, people focus on certain attributes and ignore others. And these are ways in which behavior can change.

Let me say this is just about 20 years since I stopped smoking myself. And, you know, the sort of analysis Charles River assumes is that I smoke because I prefer that to not smoking; and if you force me to stop smoking, I would be worse off because I wanted to smoke because I did smoke, and therefore, there must be a welfare loss because you stopped me from smoking.

And I know in the first month or first six months, my wife will tell you there was a welfare loss.

(Laughter)

DR. HANEMANN: But the fact is, I got used to it. There is no sense now in which I am worse off because ten or twenty years ago you forced me -- you removed something from the marketplace that I would have chosen to do.

I mention that as an example of changes in preferences. You have changes in technology, but you

also have changes in preferences. People see things differently.

And there are adjustment costs. I'll come back to that.

But you can't do an analysis from now to 2050 which assumes people are set in their ways just as you can't do that with technology.

So item one is market failure.

Item three on my list is sort of the opportunity to change preferences, how people see things when you change technologies.

And item two is just conventional economic substitution. People switch input so they switch commodities as prices change.

The Charles River model has the price substitution but rules out the other two factors.

Mr. Tanton's analysis rules out all three factors.

The Air Resources Board model tries to cover all three factors. It allows for two. And it tries in some way -- to some degree to allow for one and for three.

And I would actually disagree with the EAAC report which says it is not possible to tell which model -- which set of models comes closer to the truth.

I think it's clear to me that the ARB models come closer to the truth.

What you can't say is how close and what is the gap.

But there's no doubt that one needs to account for all three models; and of the models on the table, the ARB models are trying to come closest, of the ones on the table.

Next slide.

It's already been mentioned, but the reason why it matters tremendously if you have ten economic producing sectors instead of 50 or 70 or 100 is that you have gains for -- you have the potential for gains for trade among the sectors.

If there are ten sectors, there's much less potential for trading. Any one sector has only nine other sectors to trade.

Each sector is assumed homogeneous. Each sector is essentially treated as identical. And so having only nine trading parties versus 99 other trading parties has to bias the gains from trade down.

On the other hand, the Charles River model allows trade between regions. But I think the degree of trade, the degree of production shifting, the degree of employment shifting, is actually unrealistically large

as a result of the way in which the model was calibrated. I'll come back to that.

Mr. Tanton made several points that I think are valuable. There is uncertainty. There is uncertainty about the models themselves. There's uncertainty about the inputs that go into models. And so there is a range of uncertainty.

But I think his analysis is really off base for four reasons.

First of all, he is using a model that doesn't predict, let's say, a $60 carbon price to analysis the economic consequences of a carbon price, and there is a fundamental logical inconsistency because nothing about the structure of the model is consistent with the economic impact that comes out of the economy that it's analyzing. That's the first thing.

The second thing is a $60 increase in the price of carbon in 2012 is a figment of his imagination.

It's one thing to say there's uncertainty. He could have as well analyzed a $6,000 carbon price in 2012.

You have to have some basis for talking about a $60 price in 2012 other than that was a number suggested for 2020 or 2050 and it's as good a number.

The third thing, and this has been alluded to

in the EAAC report, if somebody buys a permit for $60, somebody is receiving $60 for selling or auctioning the permit. And in Tanton's analysis, that $60 vanishes from the face of the earth.

And lastly, if there were a $60 purchase of the permit, and the $60 vanished from the face of the earth, Tanton's model exaggerates the impact of that because it has no substitution.

So for these reasons I think it's significantly off base. I'd like to come back to other points so . . . The other general point --

PROFESSOR GOULDER: I'm going to alter the format a bit.

DR. HANEMANN: All right.

PROFESSOR GOULDER: You'll still have the floor.

DR. HANEMANN: Sure.

PROFESSOR GOULDER: But you've obviously introduced some strong claims and criticisms here.

I would like to give the modelers a chance to reply -- I think that would be most informative -- before it's too much history.

But you started with some comments that were critical of the Charles River analysis model with respect to complementary policy, so I was going to ask

Paul if you had any response to that.

DR. BERNSTEIN: I don't like him at all.

(Laughter)

DR. BERNSTEIN: If I can, I'd like to clarify one thing that I think is actually a mischaracterization, and I'm curious what you actually think, Larry.

When we talk about this issue of having more sectors or fewer sectors creating a bias, that's not right, what is said here. And let me just give you a simple example.

I would actually argue in fact that having fewer sectors, we underestimate the costs.

Take the example where if you had two sectors in the economy -- if we broke up the sectors in the economy into ones that only use coal and ones that only use gas. Okay?

Then you look at a model that aggregates those sectors so they use coal and gas.

In the one where I am aggregated in one sector, I have the substitution opportunity between coal and gas.

In this other one where I only have coal and gas because they produced totally different products, that substitution possibility doesn't exist.

That's realistic that it doesn't exist.

In the CRA model actually, we aggregate various sectors, various energy intensive sectors. We actually have substitution opportunities that actually don't exist in the real world.

And I don't understand the issue about these gains from trade. I think that's a misstatement as well.

Going to the issue regarding the complementary measures or what have you, I think that's -- I think that's a great example, actually, the smoking example.

I think Larry talked about his example when it comes to recycling.

But the problem that we're faced with in this analysis is we can't afford to let the consumer's choice set change as we go through the analysis. If we did, we could get any result we wanted.

Because I could take the consumer's preferences today, and I'd say well, after the policy the consumer's preferences are either they love this policy, or I could say that they're really pissed off about this policy, and I could make the costs even look far worse.

So I think that's just a downside. I'll just let -- Larry's much more knowledgeable than I.

But I think that's just a shortcoming of

welfare economics, and we're kind of stuck with that.

PROFESSOR GOULDER: Okay. Thanks.

Before we ask Tom to respond, I just want to say one thing about the complementary policies.

My original response was exactly like yours, that the complementary policy -- the lack of -- the CRA model was not giving the complementary policies enough credit; therefore it biases toward upward the cost.

In fact, a very recently publicized appendix to the economic impacts analysis has a plus sign saying that the Charles River model is therefore biased upward in costs because of its treatment of complementary policies.

This morning -- or today my view has changed. I think it works both ways.

I think that there are likely to be some complementary policies that would reduce overall costs of AB 32, but not necessarily all of them.

And as has been suggested by Tom Tanton, there may be some wasteful ones as well.

So at this point, I think it's not clear what the bias is from lack of closer attention to complementary policies. I think it could go either way.

Do you have a comment on point?

DR. ROLAND-HOLST: No, I just want to join in

at some point. I'd like to speak about these issues.

PROFESSOR GOULDER: Should we finish this discussion?

DR. KEVIN KENNEDY: Please be sure when you're speaking to turn the microphone on and use it, particularly for the folks on the webcast.

PROFESSOR GOULDER: Let's now turn the floor over to Tom to respond to some of Michael's comments.

MR. TANTON: Thank you.

I think the first one I'd like to respond to is the issue of substitution, technological and fuel.

You suggested I ruled it out. I did not rule it out. I didn't rule in. I simply did not evaluate that. Okay.

So I recognize there are -- there's likely to be fuel and technological substitution, but the question is whether that's allocable to the Cap and Trade program that I analyzed.

PROFESSOR GOULDER: Specifically, you assume that the expenditure by consumers or by firms on various energy products and other products, that those expenditures don't change, the propositions don't change --

MR. TANTON: As a result of the Cap and Trade.

PROFESSOR GOULDER: So basically there's no

elasticity.

MR. TANTON: Correct.

PROFESSOR GOULDER: Okay.

MR. TANTON: I did not estimate elasticities.

The other is what Dr. Hanemann suggested was an overreliance or emphasis on $60 a ton. I didn't assume that was any more or less likely than the range from 20 to 200 which I basically took from the EAAC report.

I didn't try to predict the auction price, either in the near-term or later term, but I think the results indicate that, whatever the costs are, are highly sensitive to what that price clearing happens to be as well as the volatility.

So that would be my response.

PROFESSOR GOULDER: Okay. I'm going to turn the floor back to Michael, but I think let's do it this way. We're kind of changing the rules as we go. If there's an issue --

MR. TANTON: I would suggest that ARB keep that in mind as they go forward with AB 32, that the rules need to be predicated on the 3M rule -- and not Minnesota Manufacturing company but measure, monitor, and modify as we go forward.

Things are going to be different than what we believe today. We're going to be smarter tomorrow than

we are today.

PROFESSOR GOULDER: Okay. So if any of the panelists have a comment to make that's on the issue that's currently under discussion, whether it was complementary policies or, for example, degree of flexibility in a model, that's fine; I think we can keep things focused that way.

So David?

DR. ROLAND-HOLST: As the one who hasn't spoken yet, I'll speak first.

Let me just say something about this 2012 permit price. I was told by CARB to calibrate the permit price to zero in 2012 because the cap would be nonbinding in the year in which it was introduced. My sense is it was going to be calibrated to that.

That would lead to a huge bias in any results that assumed a positive and significant price from the outset. So yeah, I'm very concerned about that bias, but there's information available on what that should be calibrated.

Secondly let me talk about aggregation bias very briefly because otherwise we're going to get bogged down in a technical debate between academics. I don't want to do that.

This is a very well established problem in

modeling, and aggregation bias is a significant and serious issue. It can't be dismissed with simplified examples. I'll give you a quick one, though, for practical purposes.

When we did the national work for the eagle model, we got significantly lower adjustment costs from the national Cap and Trade because we modeled all 50 states, much more diverse set of economies, to accept the adjustment burden, and much more sectoral detail.

And that's not -- it doesn't make our work approach superior, but it does identify a broader spectrum, so I would strongly advocate more detailed assessment as a way of finding these adjustment opportunities.

And finally, on the issue of market failures, I'm really surprised that there is a still a debate about the existence of market failures. We have multibillion dollar financial markets that are dealing with this on a daily basis.

Student loans. Micro credit. Look at the history of energy efficiency technologies that has been chronicled in California.

These markets -- market technologies are replete with market failures. And the State can play a very constructive role, but of course it has to do so

with care.

PROFESSOR GOULDER: I think there's agreement that there are open market failures, as Michael has indicated.

I think the question at hand is though whether the specific complementary policies, each one of them, addresses market failures in a productive way.

Maybe some of them do and thereby lower the cost, but others may not and in fact may raise the cost.

DR. ROLAND-HOLST: There are no rules of thumb generally that will work.

And also to this point that was raised earlier about adding measures that introduce additional fees and taxes, we are not in a first best situation.

There are plenty of distortions all across the economy, and introducing one more or one less, there's no general rule that would improve aggregate efficiency or make aggregate efficiency lower.

PROFESSOR GOULDER: Okay, Mike. You've got a few more minutes.

DR. HANEMANN: Thank you. Let me just say one thing in response to Tom.

You said, Tom, you were agnostic. You said that for example the way consumers allocate their income among commodities could change, but you were making no

assumption that that was the result of Cap and Trade.

And it's true that they could change for other reasons. People could decide to give up smoking or to give up -- you know, worry about obesity and avoid fatty foods. There will be other changes.

But if there were a $30 or a $60 price on carbon which raised energy prices, it's taking agnosticism, you know, a little too far to express agnosticism as to whether that won't have any effect on consumer behavior.

And that's the sense in which assuming no price effects, I think, is both wrong and likely to bias things upwards. How much upwards, what are the things that will change consumption as well, of course there's uncertainty.

But that's -- there will be price effects, and particularly, you know, with higher prices.

MR. TANTON: I fully agree there will be price effects. I also assert that there will be other performance effects. That is, it's more than just price.

DR. HANEMANN: Yeah, well, I agree with you. And I'll come to that in my last slide. Wherever I was, can I go back quickly.

(Laughter)

DR. HANEMANN: Yeah.

So I want to make just a general point. This is expressed in an arcane and artless manner, but I think it's important.

Models are calibrated to economic conditions in base year, whether the base year is 2007 or something else.

But the models are used to predict, most of the time, to predict the effect of some intervention, a Cap and Trade, a gas tax increase, whatever.

So we're actually interested not in the structure of the economy in any given year, but in the change resulting from a policy intervention.

Models are not calibrated to interventions. Models are not being calibrated to whether they could predict the effect of the electricity price shock in 2000 or, you know, the -- for that matter, the gasoline price increase of three years ago. They are not predicted to calibrate the effects of changes.

Now if the model was correctly specified and correctly estimated, it wouldn't matter because you could calibrate the model to one thing and predict to another thing if everything is correct.

But we don't know if it's correct, and the fact is it might not be.

And the habit of not calibrating models to the type of interventions we're trying to predict lends an air of unreality to the models. Let me go on --

CHAIRPERSON NICHOLS: This is so reassuring.

(Laughter)

DR. HANEMANN: It is one of the secrets of model building.

And therefore one of the questions one needs to ask is -- see the models are calibrated, say, to 2009, and then we project out to the future.

Long ago, Henri Theil built a model in 1965 and projected the past. The one advantage -- so the past won't be the same as the future. But the one advantage is you know the past, and you can see how good a job the model does of predicting things backwards.

In particular, you know, past intervention, you could start the model in 1955, look at an intervention, and then you could see what the model would say going ten years forward, and you could see what happened.

And as a concrete example, you know, can a model predict the Rosenfeld effect? Can a model predict what happened to refrigerator prices?

Or would the model think that refrigerators would become much more expensive, there'd be a reduction in the quality or the use of refrigerators and so on?

That's the point I want to make.

Some effort -- and I know from the work by the Energy Commission in 2005, some effort has gone into this with the ARB models. Not a lot of effort, and I think that needs much more effort in the future, but that's one of the criteria we should use.

Next please.

CHAIRPERSON NICHOLS: Could I just stop you for a second, because this is something where I feel like maybe I do know something, so I want to check it.

I have some experience with air quality modeling. In the world of air quality monitoring, that's exactly how you test whether a model is the one you want to use or not.

You look at whether it's capable of predicting past episodes based on things that you know that you did.

So is what you're saying to me that we either haven't done that or couldn't -- or somehow couldn't do it with respect to the models that we're now using?

DR. HANEMANN: So there are complications, of course, because if you start in 1955 and you project, other things may have been going on after 1955 which you can't control for.

So it's not easy, and it's not -- and you can't

do it perfectly.

But I think there should be more effort to doing that. And particularly when today's -- some of today's models actually existed in versions in 1990 or 1995. But there should be some concerted effort.

So what I would say is it's not easy, but for the most part there's no attempt to do that and -- or very little, and that's something that I would encourage.

CHAIRPERSON NICHOLS: I would think so.

DR. HANEMANN: Yes.

Well, so one -- a crucial -- the models are equilibrium models. And what happens is even if we're in equilibrium now, we're changing to a new state and there's a path of adjustment.

And how quickly the adjustment occurs and how costly it is, what the adjustment cost is not included in the models.

And again, that's something where it's difficult, but there should be an effort to try and incorporate those facts.

And a particular chunk of this is associated with capital being turned over.

And so the equilibrium might be to retrofit all the widgets with this, but maybe only 30 percent will

get retrofitted in any one year so it will take three or four years.

Next slide, please.

I think I've just got two major points.

With regard to benefits, it's been noted that the models don't deal with the benefits, whether they're greenhouse gas benefits.

The last bullet here is something that is not widely understood in the modeling. Technically, it's been assumed that whatever is the water quality or air quality or temperature or drought or whatever doesn't affect the market economy very much, so the environmental impacts are assumed to be separable from the market ones and can be ignored.

My friend and colleague Harry Smith has a couple of papers showing that actually that's not true, and that even if you didn't care about the environmental benefits, but these things disrupt the labor supply, they change what market commodities people want to purchase, and those things have economic consequences, and so all the more reason to bring in the environment -- sort of the environment alongside the market economy.

Next slide.

This gets at what Tom said. I've spent quite a

bit of time over the last two years looking at the actual experience with emission markets in the US, for SO2, for NOX, for lead.

And I concluded that much of the change was not triggered by prices, but I think it was triggered by the caps placed on individual firms which seized the attention of senior management, made these issues salient, and led them to change things.

So I would agree with Tom that in fact the empirical evidence is that there were no price changes to speak of outside the sector that was regulated.

All of the action was that the sector that was regulated paid attention to the issue, found new production technologies or new ways of doing things which got rid of the problem at a minor cost.

Next slide. And this is my last one.

So just because that worked in the past, just because it worked for SO2, absolutely doesn't mean it will work equally well. Greenhouse gases are much more complicated, and the future is perhaps more complicated.

But it does mean that there's more in the world -- there's more in heaven and earth than the models allow for. There's an incentive with the price of regulation to figure out some way of dealing with the problem, and that leads you some of the time to

solutions that are not in the existing model.

And I think this is an area, the calibration of the past and trying to be sort of realistic to the future, this is something which I think the ARB staff should pay attention to.

But it would need the staff and the resources because what it's done right now I think has been exemplary, but that's been a lot of effort, and we're recommending additional effort to be loaded on.

Thank you.

PROFESSOR GOULDER: Thank you, Michael.

I just want to amplify one point that you made. I know we were all rushed, but you mentioned this issue of salience.

Your recent research suggests that since salience is important, it makes a difference whether you introduce a cap and trade system upstream or downstream because that's going to indicate where the salience occurs.

Economists tend to have this view that it doesn't matter, that the overall impacts on various firms are the same irrespective of whether it's up or down. So that's, I think, an important issue.

DR. HANEMANN: And we're referring to some work by your student, Ken Gillingham, which has shown that

which I think is a terrific study.

EXECUTIVE OFFICER GOLDSTENE: Dr. Goulder, could I ask a quick question? And Dr. Hanemann.

On slide A, you recognize the fact that we are not -- we haven't or maybe it's not possible to model the climate and environmental impacts alongside the other modeling we're doing.

Is there a way to go about doing this that you'd suggest we should look at?

DR. HANEMANN: I would say yes, but you sort of build up, branch on it.

But one can -- there's issues of resources. There's issues of data. And there's issues of implementation, including calibration.

Kerry Smith's recent work with his former pole star Carbone shows a technical way of doing the calibration. And the calibration becomes more complicated it turns out when you have -- than conventional calibration.

So the answer is I think this is practical, but it will take time. And you sort of want to start slow, but I think you want to set this as a goal.

And given all the work on impacts and the other work that the Air Board does with regard to air pollution effects, you more than any other agency sort

of have the data in hand. So I think that would be an appropriate path to start going down.

PROFESSOR GOULDER: There's a growing industry of so-called integrated assessment models which try to build together both the environment and the economy. I know the EPA has some models of that sort.

But as Michael indicates, you know, the more the scope of the model, the more difficult it is in terms of data and calibration.

So Hal, you're on.

DR. NELSON: Great, thank you.

I'd like to extend my thanks to the Members of the Board and Larry and staff for getting me up here from southern California. I think I'm the only SoCal representative.

My only complaint I guess, and it's a small one, is that I have to follow Michael, and I'm not sure that my SoCal surf dude accent is much of a selling point, but I'll do my best.

As the slide indicates, I'm a research professor at Claremont Graduate University. My research is on energy policy and policy evaluation.

And for the last -- is that feedback coming from me? I have enough ringing in my ears. I don't need any more.

CHAIRPERSON NICHOLS: Usually it means we need to move all of our Blackberries and similar equipment away from the microphone. They seem to not like that.

DR. NELSON: Okay.

For the last several years, I've been working for the Center For Climate Strategies.

Next slide and -- or slide, period.

(Laughter)

DR. NELSON: And the Center is a nonprofit that works with state governments to develop climate action plans. And we've done these in over 16 states across the US.

And these climate action plans are unique in the sense that they are developed by stakeholders from, you know, all sectors of the economy and all professions.

I recently did an analysis of the stakeholders and the impacts of the stakeholders on the outcomes. It turns out that the energy sector is the largest representative of the stakeholders.

So this isn't a bunch of environmentalists sitting around thinking how are we going to save the planet, but industry folks looking at what can we do, you know. What is desirable and achievable for these states to do to reduce their greenhouse gases?

Next slide.

So what I'm going to talk about here today briefly is some of the macroeconomic results that we have gotten from -- we've done four macro studies. You can see which states they are up there.

Adam Rose has been -- and Dan Wei at the University of Southern California, have been primary suspects in all these reports.

My role has been as the liaison with the energy sector. I'm more of an energy guy and less a macro guy, so I'm not going to be able to comment on a lot of the aggregation bias and whatnot except from how it affects my work and how we operationalize our results.

So these Climate Action Plans are similar to California's in a lot of ways. We have what you would call complementary policies.

We also have what you would call offsets in the ag, forestry, and waste sector. These are economy-wide plans. And it's a mix of policies as you can tell, price mechanisms and codes and standards.

Next slide.

So here's an example of a cost curve from the state of Michigan. This is one we did. The Climate Action Plan was in '08, and then we did the macroanalysis end of last year.

As you can see here, this is your classic kind of upward sloping supply curve where you've got price on the Y axis, and on the X axis -- I don't know if you can read that or not from where you're at. I don't think you have a copy of this presentation, members of the audience, but.

So this is a percentage reduction of the 2025 Business-as-Usual greenhouse gas emissions.

So you can see there that -- if you look basically underneath the 0 axis and you look out to the right, you can see that about a little over 25 percent of the state's -- Michigan in this case -- greenhouse gas emissions can be mitigated at negative cost.

That's net economic benefit to the state.

Then the supply curve on the other side of that axis gets a little steeper.

But nonetheless, you can see, you know, at around $50 a ton you can mitigate about 40 percent of the state's estimated greenhouse gases.

The other thing I should point out here -- I don't know if you can see the colors, but probably the color that's easiest to see is the orange, and that's what you consider demand side management. We call it residential, commercial, and industrial. Those policy options constitute the bulk of at least the negative

costs of supply for the state.

So what do we do with this data? Well, we have essentially cost data for every year for every one of these options, we call them policy options. Some states there's 50 or more of these.

And we then plug those into what's called the REMI model, which is a really commonly used model for evaluating policies. State governments love it. It's unfortunately quite expensive.

And there's a description of the model there, but it's been around for a long time, and it's pretty widely accepted for this type of policy analysis.

And importantly, it has very detailed representations. It has 169 sectors. I'm going to come back to that, and the importance of that in my work, in a minute.

So slide six is kind of the money slide for folks, trying to keep your attention here before I get into the weeds on some modeling stuff, and then I'll probably lose you, mentally if not physically.

But you can see here the different states, and the date of the reports, these are all relatively recent. The target year. The percent reduction in -- from the Climate Action Plan. And then the macro impacts.

So I call it GDP. Other people call it GSP. I don't know what the Bureau of Economic Analysis is calling it this year, but -- so you can see in Michigan a positive 2.3 percent gain in GDP and a 2.7 percent estimated employment gain.

Now this -- remember, Pennsylvania is a big coal mining state. So what we're doing in Pennsylvania by reducing -- you know, you saw a lot of the supply of greenhouse gases come from essentially demand side, so you're displacing a lot of coal miners.

And I worked in Pennsylvania with the energy supply group, and that came up in basically every meeting: What happens to our coal miners?

Well, it turns out that you substitute your coal miners for energy efficiency equipment installers, evaluation, monitoring evaluation, and other essentially -- I don't know if you call them white collar, but blue-white -- maybe a light blue collar worker.

This is a pretty diverse group. So Florida, I think, would have a similar kind of economic structure to California. You can see positive gains there as well.

Pennsylvania and Wisconsin -- I'm sorry, Michigan; I misspoke. Michigan, they have not such big

coal mining. Pennsylvania has big coal mining. You still see modest employment gains there as well.

And then Wisconsin, and I compared California here as well.

So granted, this is what we call a small end study, a small sample. But you can see that our results anyway indicate that these climate action plans have positive effects on economic performance.

And, you know, you can argue about whether negative half percent or positive half percent is noise, but I think when you are framing this and you're pitching this policy to the public, if you can say that these are likely to lead to good outcomes rather than not bad outcomes, it has -- it's a much more powerful talking point, right? And I know Chairman Nichols was looking for talking points.

And Inyo is kind of a unique place, so we discussed before there's a lot of diversity in the counties of California, so this is -- obviously, you know, you can't make generalizations across the economy, but if you look at the kind of supply curve and the types of activities that would be happening, you know, you could see there were certainly sectors in Inyo that would benefit.

The other thing I didn't present here, we also

simulate the economic outcomes for each of the policy options. So we run these individually, and then we run them simultaneously.

And so that -- it's kind of interesting from a policy design standpoint. You can see, you know, basically which -- where the big hits to employment or the losses are from which policy.

You know, typically renewable portfolio standards, no surprise, tend to have, you know, job loss associated with them because of the negative prices on electricity, pricing effects on electricity.

Let's go to the next slide.

So at this point, I'm going to kind of shift to quickly my evaluation of the California approach. And, you know, bottom line, it's very similar to what we do.

The Energy 2020 model is bigger and sexier and more expensive than what we do which is desktop modeling, but I think that it's probably the best way to go about modeling climate policies, and I'll tell you why.

First of all, it's more representative of the real world. So you have the very detailed outputs from the energy model, and you can plug those into a highly detailed macro model, or CGE model in this case.

It's also -- talk a little bit about this, you

know, it's important when you plug these into the macro models as to what's in state versus out of state, right? The more detail that you can get in the model, the more information you're going to have about the specific employment gains that occur in the state, whether it's for HVAC installers or for wind turbine manufacturers and installers versus what happens in Nevada versus what happens in Michigan.

And I think it's also important -- I'll talk a little bit about this in my last slide -- that we move beyond this market failure debate.

I mean I've worked in Iowa. The Public Utility Commission in Iowa is considering a one and a half percent new energy efficiency mandate in the state, new, you know, every year.

New York is doing the same thing.

So, you know, regulators recognize that these are cost effect sources of new supply. They're the ones paying the bills. I think that -- and we have sophisticated methodologies for monitoring free-riding and spillover.

So I guess, you know, to kind of summarize, I don't think of these as complementary policies, especially demand side management. I think of these as core policies.

And rather than frame these as complementary policies, probably betraying my background as a recovering finance professional, but to think about these as a portfolio of approach, of options, right? Each with their own risk-reward parameters.

And as you expand the -- as you diversify your portfolio, you're essentially increasing your efficient frontier, right? And you're capturing alpha, right? You're capturing value, as Tom would call it.

So I think a portfolio approach is a better way of thinking about these.

So in terms -- I'll kind of skip over some of this. It maybe gets a little bit too far into the weeds, and I'm running out of time.

But, you know, my reading of the methodology is that the Energy 2020 model and the way that it's set up is potentially overstating the costs, and that could partially explain the discrepancy between what we found in other states what the ARB has found.

It has to do with the way the Energy 2020 model essentially switches, and its switching function. And Dave and I have talked a little bit about this.

And the other element of the model -- and maybe David could correct me if I'm wrong here -- is looking at the appendix of the model, there really isn't any

endogenous improvement in device or process efficiency in the model.

So by what you're saying where -- in these scenarios 2 through 5, while we're excluding all these other sources of production, we're going to find these within the Energy 2020 model, you're narrow -- you're ruling out, essentially, fuel switching because of the way the model is set up, and you're not allowing renewables because of the 33 percent target, you're funneling all those reductions into essentially fuel switching and process efficiency, but the model doesn't have any gains or any improvements in those.

So to me, that's one of the possible explanations for why the ARB costs are higher than the Center For Climate Strategy's costs.

I'm not going to get into this, but -- talk to you offline, David -- in terms how we -- sorry. This is slide nine -- how we allocate costs, capital costs from new clean energy investments.

And then as a reader, you know, it would have been helpful to me -- you do have 160 industry sectors -- to see what those are, the employment outcomes from those different sectors, instead of aggregating them up.

And I was also interested in government

outcomes in terms of revenue and employment given, you know, your assumptions.

So just in summary, you know, I think this -- the ARB approach is the best available approach and that the costs are potentially overstated for some of the reasons that I just explained.

Thank you.

PROFESSOR GOULDER: Thanks a lot, Hal.

I'm going to try pull together a lot of the comments that have been made up to now. I would invite other panelists at any point to chime in, comment, agree, disagree, as well as the modelers.

I'm going to focus on four things, and four particular areas.

One is the issue of leakage.

Second, don't mean to beat a dead horse, but hopefully clarify the issue of complementary policies.

Third is the issue of fuel substitution and more generally the flexibility that consumers and producers have to adjust their mix of fuels or their composition of their expenditures in the face of changing prices.

And the last is technological change.

So we've talked about each of these already, but try to pull some of this together. And I do have

some slides that should be useful.

Let me start with a slide that compares some summary results from three of the models we've talked about today, or three of the efforts, the Air Resources Board's effort using the Energy 2020 and E-DRAM models; the Charles River CRA International model; the model that Tom Tanton has put together; and then I've lumped together two of the US/EPA models that have been looked at for federal policy.

And this just to sort of remind you that in some sense for the California models the policy emissions reduction target is approximately the same.

The allowance prices vary. There's a lot of uncertainty there.

One criticism I would make of the Air Resources Board report is it's not real clear from the report what the range of prices is that emerges from the E-DRAM model, but it is -- closer look suggests it's in a similar range to that in the CRA model.

And I'm looking at the policies that are kind of the central case policies, not the, let's say, the unusual cases.

But I really want to focus on the last three panels here.

In terms of gross state product, the Air

Resources Board model suggests percentage change -- and these are all for the year 2020 -- of between 2 percent -- a .2 percent loss and a 1.4 percent loss in the year 2020.

And as Chairwoman Nichols reminds us, this is a loss relative to a higher value than we'd already be at in 2020 under the Business-as-Usual.

The model, the BEAR model that David Roland-Holst mentioned is somewhat more optimistic than the ARB.

In the central column, we see the gross GSP is somewhere between minus 1.4 and 2.2 percent loss in 2020.

Tanton model is about 2 percent loss.

And US EPA, again, is for the Waxman-Markey bill. Now the stringency of the policy there is only about three quarters as stringent as AB 32 in terms of percentage emissions reductions, so you probably want to increase -- multiply by four-thirds those numbers.

But what you see then is we do have a range in terms of GSP effects. But in some sense, all these model together from one perspective don't suggest a whoppingly large impact on gross state product.

In terms of the income gain or loss per household, the next to the bottom row, somewhere between

a positive number, $86 per household and minus 270 per household under ARB's study.

Bigger changes under CRA International.

And I should mention these are per household, not per person. So the numbers that Paul Bernstein gave us earlier today, the smaller numbers, were per person.

Then the central Tanton result using the $60 per ton price of allowances would be $2,800 cost per household.

And then there's issues of jobs affected.

Now in terms of as was mentioned by David Kennedy this morning -- or it seems like this morning. Earlier this afternoon. Seems like a long time ago -- either a slight gain or what might be considered a relatively small loss.

Whereas in the Tanton study, in the middle number there, that minus 485, that's minus 485,000 jobs if we have a $60 per ton price of allowances.

So I think the big question that we're all asking ourselves is: Have we learned anything here? There's all kinds of differences in results ranging from more optimistic to less optimistic.

What I'm going to try to do is sort out where I think -- what we can glean from this. I think there are some conclusions that we can draw despite the

difference.

Next slide, please.

And -- next slide please. I see. Keep going. Right. Actually, can you go back two slides. Right there.

The thing I want to emphasize here is what was mentioned before, that the allowance value is not the same as economic cost. And all of these projections for economic cost, no matter which model you are looking at, are much smaller than the allowance values.

The allowance value, for example, in 2020 could be 7 to $22 billion in California. That's much, much smaller than the -- I'm sorry -- that's larger than the economic costs.

And the reason, as was stated I guess by Michael, is that the allowance value stays in the economy.

Now some of it could get lost to other states, but a lot of it stays in California. It's used for various purposes.

Some of it could go back directly to households. It could be used to finance government expenditures, so it means effectively reducing the amount of tax increases that the state would have to introduce so that helps consumers as well. Or it could

finance -- it could be going to businesses as various subsidies.

So that one way or another, most of it stays in the economy, and I think it's important to keep that distinction in mind.

Next slide, please.

Okay. I'm basically going to settle on this slide for a while and talk about those four issues we manufactured.

Board Member Telles was concerned about the issue of leakage. And if you look at the second row here, a minus sign indicates that the item in question in the row implies bias toward lower cost than would be really the case. A plus sign is the opposite. A plus sign means upward bias to the cost.

Neither the Tanton model or the ARB models really look at leakage because they are California focused.

A nice feature of the CRA International model is that it actually has other parts of the US, and it can look at how higher costs in California lead to changing amounts of investment from California compared to other parts of the country. It can also look at how composition of consumption changes across regions.

It's important as Dan Sperling said to look --

I'm sorry. That's -- it's important to recognize that leakage can be overcome.

So these minus signs are minus signs if it's a policy that isn't doing anything about leakage. But as indicated in the EAAC report, and also as work at the US -- at the federal level has shown, there are ways you can overcome leakage.

I won't have time to go into the details, but there are such things as first deliverer policies or output-based allowance allocation or border adjustments that can deal with leakage.

So although there are minus signs here, it's not necessarily the case that there's going to be leakage or significant leakage under AB 32. It depends really on policy design.

And as just mentioned again, Reid Harvey, the work at US EPA has looked very closely at leakage under Waxman-Markey and shown that output-based allocation can eliminate most of the leakage that would otherwise occur.

Second issue that I want to look at is complementary policies. We already -- and so that's the next row where it says restricted scope for preexisting market failures.

The ARB analysis I think does a very nice job

of looking at potential preexisting market failures. At least they implicitly account for them. As was mentioned, one could try to look at that in more detail.

I haven't had a chance to look at David Roland-Holst's recent work, but it certainly assumes there's significant scope for preexisting market failures.

The CRA International and Tanton models do not, and so that would suggest an upward bias to the cost.

However, I guess I want to pull back on that a little bit. As Dan Sperling said, details count.

So even if there are other market failures, it doesn't necessarily mean that complementary policies are going to lower the cost. It's going to depend on design. Some complementary policies might be poorly designed and add to cost.

Next slide, please.

So I'm going to try to get a little more detailed here, a little bit more concrete. In ARB's analysis -- let's look at one of the complementary policies, Pavley II, alone.

In their analysis, and I think it's a nice feature, they look at AB 32 with and without Pavley II. And the presence of Pavley II reduces AB 32's cost.

And the reason is Pavley II which, as you may

know, it's restrictions on greenhouse gases per mile of automobiles, or it's effectively like tightening fuel economy standards.

It really forces people to buy different cars, more fuel-efficient cars, than they would otherwise.

The cars become more expensive so there's an additional purchase or capital cost, but the fuel savings exceed those capital costs in that model. That's based on some empirical evidence.

In the CRA analysis, this doesn't happen. It's just the reverse. Pavley II effectively, as with the other complementary policies, adds to the AB 32's cost.

Which should we believe?

Now in the CRA model, it's assumed that consumers are already doing what gives them the best mix between the price of a car that you pay and the fuel savings. They're already optimizing.

So any policy that you introduce that forces them to do something else per force is going to make them worse off.

So then it really becomes an empirical question: Is it the case that under Pavley II the increases in the prices of cars are going to be less than the present value of the fuel savings? That's an empirical issue that needs to be sorted out.

So the fact that you're not -- different views on Pavley II don't necessarily make one view right or wrong. We really need more of the empirical information. And work is being done on this.

Next slide, please.

So the issue of absence of potential for input substitution, we talked about that, and I think I don't need to say any more. I think we might have different views about it.

My own view is that there should be some potential for consumers to flexibly adjust, in particular to sort of wean themselves from energy intensive goods as prices increase.

But I can understand there's other views on that.

Technological change issue I think is a very important issue. That's the next one. David Roland-Holst had a lot to say about this. The -- yes, stay there please.

There is technological change implicitly in the ARB work. I think it's a nice feature in that they've looked closely at not only today's technologies but potential new technologies that are likely to come into place over the years. So it's done -- it is in the model.

The CRA International model also has I believe exogenous, sort of built-in technological change.

Neither model has policy-responsive technological change, that is that the rate of technological change is altered by policy intervention.

That's something which implicitly David Roland-Holst's work attends to by saying there's this .4 percent increase in the rate of technological change when the policy is introduced. It's done in a somewhat cumbersome manner, but that's I think what you're getting at.

So I think we can agree that there's going to be some technological change, and moreover that there's probably going to be some policy response to technological change. So I think the absence of that feature does tend to bias upward the cost.

And I think in the interest of time I won't go into the others, but these two charts I've indicated, one with model results compared and this one now with the biases, are in the revised appendix to the ARB's economic impacts assessment of the Scoping Plan.

It's been substantially revised over the last month. We had more time now to look more closely at the plan and also to consider other models.

So there's more than I have time for here, but

rather than monopolize the conversation, I was actually hoping that we would get some back-and-forth on these or other issues.

Why don't we -- anyone, the floor is open now. If Board Members have questions about any of these points or other points, I think now is a good time to bring them up.

BOARD MEMBER SPERLING: Could I ask kind of an overarching question?

My sense of this discussion in reading through your reports from the EAAC committee is that there is pretty much agreement about this 0 to 2 percent reduction in cost and, you know, it could be a lot or a little, you know.

It's roughly 30 percent growth so the actual growth would be 28 to 30 percent over the next ten years.

And so I guess the real question I think for all of us up here is: Is everyone comfortable with that conclusion?

Because if you are, then we can move on to the following questions which actually have to deal with the implementation of the equity impacts, the actual design, you know, and there's a lot of questions there.

PROFESSOR GOULDER: If you'll let me, I just

realized I had two more slides that you offered a perfect segue to.

(Laughter)

PROFESSOR GOULDER: Let me answer your question with the next two slides. Or partly answer it.

The first is, I think we're essentially interested in the overall economic impacts as well as the impacts at the local level. And it's easy to get lost in the weeds with these models.

But exactly as you started, the premise of your question was that there are sort of the general conclusion that the -- if I heard you correctly, that the net costs are not terribly large relative to the California economy.

I should also mention this comes from models that are very different in their structures and their inputs.

So this is -- you put it in terms of total growth over the next decade. If you look at average annual rates of growth, it's just the point you made, that under Business-as-Usual both the CRA analysis and the ARB analysis and Tom Tanton's analysis basically I think assume about 2.4, 2.5 percent growth on the average over the next decade.

Under AB 32, it goes down by .1 percentage

point under CRA's analysis and by probably less than that under ARB's. So now we can ask the question are we comfortable with that.

Let me postpone just for one more second and look at my last slide which I forgot to do.

Next slide, please.

And there's the question of what about the impact on specific industries. Just the fact that it's small over all, they could be big losers.

And a nice feature of the ARB analysis I think is it does show a lot of detailed effects. And in particular, it shows that the energy intensive trade exposed industries could experience significant losses.

But again, this is a loss relative to the growth that's going to -- that would occur under Business-as-Usual.

So under the ARB analysis, value-added in two industries that are affected the most are mining and utilities. They experience about ten percent loss in value-added relative to Business-as-Usual.

But it doesn't mean that value-added isn't growing. It is still growing at a somewhat slower rate.

The important point I would make here and it gets to your point of equity is that losses can be reduced or even avoided through other features of AB 32.

For example, under the Cap and Trade program, you can avoid losses through output-based free allocation, other forms of free allocation, border adjustments, recycling of optioned revenues.

I think that's terribly important and the details count.

So that was a long way around getting to an answer to your question, but maybe we should ask others around here. Are they comfortable with these? Do they agree with this general conclusion?

My overall assessment here, and I think this comes not just from the ARB study but from all the models together, is the effects are relatively small and that the large effects, the relatively large effects in some particular industries, could be cushioned through specific aspects of allocation or other aspects of policy. You've got a lot of allowance revenue that could be used for compensation, for example.

What are other answers to this question? Yeah, David?

DR. ROLAND-HOLST: Thank you very much. That was a really able synthesis.

I would like to just emphasize those two last conclusions, that the opportunities for adjustment mitigation and the opportunities for innovation

potential are areas where I think we could have a new generation of assessment.

And really, at this stage, you might call it fine-tuning if you want to, but I think if we have -- we have four models, three of which agree that we're in the less than one percent region most of the time in terms of the overall adjustment, a couple of months of growth in a decade.

Then these issues of fine-tuning might actually overcome even those small macro changes, but they would certainly mitigate some of the most important anxieties I think in terms of bottom-up responses to these policies.

And I'm talking about everything from the so-called energy intensive or the pollution intensive sectors to things like green micro credit for small enterprises.

I mean there's a place where we've got some really big market failure issues in terms of technology adoption. So moving onto that stage, I think, could really be an important component of this agenda.

PROFESSOR GOULDER: Tom?

MR. TANTON: I think we need to keep in mind that there is both the issue of the size of the change, whether it's two percent or one percent, but also the

structure of the change.

What we're talking about is a fundamental change in the structure of the California economy further away from manufacturing and more towards services.

I think that's an important question as well, in terms of productivity, in terms of wealth creation for the economy as well.

There's different kinds of service economies. We could be giving each other haircuts, or we could be doing finance and banking and internet kind of stuff.

So that's an important aspect of looking at it, not only is it changing in size, albeit de minimus, but it's changing in nature.

We've heard a lot about the energy efficiency improvements that California has achieved over the last two decades. Much of that came from a fundamental change in the structure of our economy as well as the standards and programs.

That's all I have to say about that.

DR. HANEMANN: To the extent --

CHAIRPERSON NICHOLS: I'm sorry. I'm going to interrupt for just a second because I think I need to follow up on that a bit.

I don't have charts and slides and numbers in

front of me to make this assertion, but I have been briefed fairly recently in southern California about the kind of work that Professor Nelson was talking about and others about what actually is going on in the economy, at least in that part of the state, and the statement that there's been this fundamental shift away from manufacturing I don't think is quite correct. I think maybe there's a --

MR. TANTON: Let me rephrase it.

CHAIRPERSON NICHOLS: Okay. Because there's a lot of small manufacturers --

MR. TANTON: There are.

CHAIRPERSON NICHOLS: Lots. And growth in that sector.

MR. TANTON: Manufacturing remains exceedingly important.

CHAIRPERSON NICHOLS: Right.

MR. TANTON: As a percentage of the total --

CHAIRPERSON NICHOLS: Right.

BOARD MEMBER TELLES: -- it's been diminishing.

So it's still important. It's still -- it's bigger than service, but the relative proportion is changing.

And it changed in the mid '90s when we came out of our first recession -- or an earlier recession, and

we lost much of the aerospace.

CHAIRPERSON NICHOLS: Right. Fair enough.

Dr. Balmes.

BOARD MEMBER BALMES: So just following up on that. So I understand with last energy crisis from the loss of aerospace we lost aerospace manufacturing.

But you made the assertion that AB 32 would further accelerate loss of manufacturing, and I'm not quite clear on that. I want to know if everybody else agrees.

MR. TANTON: I think what the modeling shows is more reduction in mining and energy than in other sectors of the economy.

PROFESSOR GOULDER: That's correct in the absence of some other compensation mechanism like an output-based allocation.

MR. TANTON: I would also suggest that when we look at border adjustments that we bring in some of the legal folks. Because some of the border adjustment mechanisms may in fact violate the commerce clause.

DR. HANEMANN: Here's the thing. I would make one prediction I think fearlessly.

There are not going to be more haircuts as a result of AB 32. There are going to be more installers of insulation. There are going to be more smart

monitoring of buildings and energy use and things like that.

In other words, this is imparting a particular direction. And there may have been, and I agree it would be regrettable, an increased trend to haircuts over the last 10 or 20 years.

But AB 32 is extremely unlikely to push that. In fact, what's happening is the substitution of information for manufacturing.

You don't need maybe as big a gizmo, as big an air conditioner. What you need is a smarter air conditioner tied to sensing around the building.

And so instead of one big widget, you might have a small widget and lots of sensors. And whether that's -- and that might be classified in part as services.

So I think the whole point is a shift. What we're substituting information to provide services, some of which before came from sort of raw physical machines.

DR. BERNSTEIN: Can I go back to a previous question?

CHAIRPERSON NICHOLS: Sure.

DR. BERNSTEIN: I would say from our analysis, whether the cost is a lot or a little, that it shouldn't be that big of a surprise that three of the models come

up with similar results because we were asked to standardize on a set of assumptions.

So I think to me, at least, when I look at this the second question is fairly important. What if those assumptions are wrong?

What do we need to do in terms of the policies to make sure that we have off-ramp safety valves, what have you, in case those assumptions are wrong?

For example, I mean just coming back to low carbon fuels. If the assumptions are right that the ARB is using, there's no problem at all.

But if it's on the other side or likely, if we look on the electricity sector, it's difficult to bring in renewables for various reasons, whether there's all sorts of siting issues with transmission or the percentage of intermittence on the grid, we can't get as much as we would like, all of that raises the cost, and we need to be careful as we put forth the measures that we have the safety valves and we have the flexibility mechanisms.

PROFESSOR GOULDER: To follow up on that if I may, you also did a set of simulations where you used your own assumptions, as it were, for some of the key inputs and cost inputs.

How much higher were the costs overall to the

economy in those cases compared to the ones that we focussed on here?

DR. BERNSTEIN: So we -- all we did is we looked at one particular sensitivity essentially. We looked at the sensitivity for low carbon fuels. And the costs were about 50, 60 percent higher with just raising the low carbon fuels.

I mean one could think about higher costs of new sources of electricity. Tom brought up the issue about the wind becoming more expensive because of the demand for wind -- for the wind turbines.

There could be various other issues that could come about. So again, I'm not trying to argue whether it's low cost or high cost. I'm just cautioning that I think there is a great range of uncertainty, and there's a range of costs, and so let's implement the policies that allow the flexibility.

PROFESSOR GOULDER: David?

DR. ROLAND-HOLST: Let me just come back before we leave to Dr. Telles's question about technology in -- domestic technology or foreign technology.

I think this is a very important point because California as the eighth largest economy has an opportunity to capture this innovation potential.

And as the President himself said, it's not a

choice of using these technologies. It's a choice of whether we export them or import them.

And the example of China is a very good one. But I do global modeling. These are not global models. So you can't capture these linkage effects.

But there's no question that we're in a very competitive environment, not just from the Chinese but the Germans are building windmill factories in the United States.

These are very high wage economies that remain competitive in manufacturing because they've maintained productivity and they've promoted innovation and these kind of technologies.

So I think if -- given the carbon liability that is looming before all of us, and given the scale of the energy sector and the fact that it's responsible for 80 percent of GHG emissions, we're looking at the next breakout technology sector.

And I think it should take its place among the other knowledge intensive sectors of the California economy, IT and biotech. And the venture community certainly sees that opportunity.

Manufacturing, reindustrialization, I don't know how far that will go. But these are manufacturing technologies that we're talking about, and they can be

captured if California incubates the market like that with its standards.

PROFESSOR GOULDER: I think we have to be careful about how much faith we put in innovation in the following sense: The number of -- the resources -- the people that can innovate, there are only so many.

So if you introduce a policy that makes it more attractive to develop the low carbon fuel or fuel cell automobile, et cetera, innovation resources -- that is engineers, scientists, and others are going to be funneled in that direction, but it means there will be less innovation elsewhere.

So it's not necessarily a zero-sum game, but it's not as big a positive sum as you might first think because it's a redirection of innovation, and how much of it is a net increase in innovation is another story.

CHAIRPERSON NICHOLS: We might have a slowdown in introduction of new cellphones or --

DR. ROLAND-HOLST: Apple products, heaven forbid there would be one less innovator at Apple. You're absolutely right.

And this issue of capturing the manufacturing component of these new technologies, I think that's an open question.

I don't see any reason why we wouldn't be

outsourcing a significant amount of this new hardware to the same place as we got our IT hardware from.

It's not like the software industry which is mainly skill intensive. There are largely unskilled labor intensive components of that.

But let me make one point again in response to Dr. Telles. It doesn't matter whether we import refrigerators or not. We will get the same efficiency gains. Households will save the same amount of money.

Now we'd like to capture the manufacturing within the economy too. But if we buy the refrigerator from the state of Nevada or Nicaragua, it doesn't make a difference in terms of the savings that we enjoy. So those multiplier effects will still be there.

DR. BUSCH: And Larry, you talked about innovation being in the Charles River model, but it's through this autonomous energy efficiency improvement rate that is lower than the historical rate. Is that correct, David? Is that -- that's what you alter in your innovation run.

DR. ROLAND-HOLST: Right, right. Brought it back up to the trend, the last 30 years.

DR. BUSCH: And I just think it's worth pointing out the low carbon fuel standard isn't one of these ones that saves money. There is a cost to it.

It's just it may reduce cost in the CARB work because the stickiness of capital stock turnover means that the price signal would be more expensive in that model.

My sense is that Cap and Trade is cheaper in the Charles River model because there's more fluidity in response to the price.

Or maybe you could -- I mean we talked about the sectoral differences, disaggregation being a possible reason that there are persistent -- there are differences in cost between the ARB and CRA work, and you thought that that wasn't the reason CRA comes up with higher costs, even when there's harmonization.

Could you help us understand where the differences come from to the extent even when you're working with harmonized costs?

DR. BERNSTEIN: I think you're right about the -- you said what, the stickiness?

I mean I think the issue in terms of the cost difference, I think there are a couple things. Larry identified them. That we weren't as harmonized in some of the scenarios as we should have been.

As Larry pointed out, the VMT measure, there was a difference in terms of how we represented it. We represented it with a cost. The ARB, there is not a

cost to that.

On the -- on some of the consumer side issues which we're talking about in terms of those market failures, the -- we actually do account for some market failures with our energy efficiency on the electricity side.

There are some -- if you look at our report, we have basically a supply curve for DSM or energy efficiency. There is some energy efficiency that would come in at quote negative costs or, you know, the benefits exceed the costs.

But for the large extent, we find that no, the costs exceed the benefits.

And some of it goes back to Dr. Hanemann's point about where the consumer preferences are.

When -- going back to Larry's car example, what we're saying is when people pick a car, that they're picking it for a set of attributes, not just fuel economy.

So if you want to look at just the operating costs and the capital costs, I think the CRA model would actually find something similar to the ARB model, actually increasing the efficiency would save in terms of lifetime costs.

But when you're doing that, you're moving to a

vehicle that maybe has less room, less horsepower, some other attributes are changing. And the consumers have said that they value those attributes. So if you're pushing them away from those, you're causing a loss in welfare.

Now we can argue are consumers making smart decisions or not. Okay. Won't do that.

But that's what, just in terms of the model working, when you go to the ARB model, it's basically, the Energy 2020 model -- and Dave, please correct me if I'm wrong.

The Energy 2020 model is basically looking at life cycle cost, and it's not taking into account those consumer choices.

So it's not taking account of any of the, you know, kind of nonquantifiable or difficult to quantify services such as roominess, horsepower, what have you. It's not quantifying those when it's making the choice in its model.

Now what it does have is it has this function in there that makes it -- that you have to have a cost difference to get the consumer to substitute into the more efficient vehicle, more efficient technology.

You have to have a cost difference above what the lifetime savings would be.

And to get more and more switching into the efficient technology, you need a bigger and bigger cost difference. Okay?

So if you're going to have it as a market-based policy, that's what you need.

Therefore, if you move to a nonmarket-based policy where you just mandate consumers to switch to this new efficient technology, by definition or by construct of the model, it improves welfare.

Because now you just move them there. They all go there. They take this more efficient technology that has lower life cycle cost. That improves welfare.

On the flip side, CRA makes the assumption that there aren't the market failures, and so by forcing the consumers away from where they want to be, by definition or model construct, there is a cost of doing that.

I don't know if that helps.

CHAIRPERSON NICHOLS: Well, I think we all have things we'd like to jump in and say at this point.

BOARD MEMBER SPERLING: I'll pass for now.

CHAIRPERSON NICHOLS: Okay.

I had a question that was just a question of interpretation of one of the slides that were presented by Hal.

And that was a comment, I think it was like the

second to the last slide, where you said we should incorporate energy efficiency into the cost of doing business and not treat it as a separate measure.

Do you recall where that was? And I just -- I wasn't sure what exactly you meant by that because we do have energy efficiency -- we have a lot of energy efficiency assumed in the baseline of our Scoping Plan.

But then we're also adding requirements for extra efficiency on top of that, and I wasn't quite sure whether you meant that should be taken out of the equation in terms of the additional costs of whatever the installation or the equipment are.

So a small point I guess, but just --

DR. NELSON: Thanks for the clarification. I guess my comment was primarily ontological more than anything else for changing their world view about -- maybe, you know, getting academics to change their world view is a moot point.

But I think in the dialogue it's important to say that this is a portfolio of policies and that demand side management is the foundation of the policies in the sense it is -- it paves the way for the other higher cost options, right? Because you have cost savings from the demand side work, and that goes to help subsidize on a statewide basis these other more expensive policies

like renewables.

CHAIRPERSON NICHOLS: Well, demand side management is the officially adopted loading order for the State of California, right? So I mean it's in the regulations now for the PUC, the Energy Commission, everybody else, that before you look to anything else you look to demand management.

So I guess you're saying that should be assumed?

DR. NELSON: I'm agreeing with that, yes.

CHAIRPERSON NICHOLS: Okay.

DR. NELSON: I'm not telling you anything you don't already know.

CHAIRPERSON NICHOLS: No, no, no. But I don't mind hearing it.

DR. NELSON: Happens a lot with my wife.

CHAIRPERSON NICHOLS: Okay.

Have you incorporated the questions that you received on the cards, or is it now time to -- because otherwise, I'm sure the Board Members could happily keep this group engaged with our own questions and comments.

DR. KEVIN KENNEDY: Yeah. And we have a listing of the questions and comments, and it probably is a good time to start dealing with them.

CHAIRPERSON NICHOLS: Okay. We did have one

more Board Member question here.

BOARD MEMBER TELLES: Question on the energy efficiency, on Professor Roland-Holst slide 9.

You have kilowatt per hour on the Y axis and then time on the X axis, and this is a slide we're all familiar with. The California economy is very efficient.

Has that translated into consumer savings also? I mean I have the impression when I read newspapers that the cost of electricity in California is so much more expensive.

I'll give you an example. The cost of electricity in Fresno where I live for a household is about twice as much as it is for a household in Tucson, Arizona. And because a lot of this, the cost would be reduced by the efficiency, but are we seeing that already with what has happened by the California economy?

DR. ROLAND-HOLST: In answer to -- the very direct answer to your question is this estimate came from CEC, and it does include -- it is adjusted for price differences between the national average price and the California state price.

So yes, households saved over this time period $56 billion.

My estimate of the multiplier effects of those savings was additional 1.4 million jobs over the same period were created by diverting that demand from energy to more traditional spending patterns, haircuts, espresso drinks, and Walkmans and lots of other fun things that consumers like to buy.

But that job creation also had a follow-on of forty-five billion in new payrolls that would not have been there if we hadn't been able to recycle those savings.

But the actual estimate of the savings, to answer the question specifically, is adjusted for rate differences in California, and it's an official estimate of the California Energy Commission, not my number.

CHAIRPERSON NICHOLS: Okay. Are we ready to go with the audience questions? Okay.

DR. KEVIN KENNEDY: Before we get started, part of what I'm about to do is we had typed up the questions and I'm going to hand them out to the people to more or less -- we were hoping to organize them into themes, and we found that we were not terribly successful at doing that.

There's a lot of divergent sort of questions around. Some of them are relatively simple. Some of them are probably things that we may need to end up sort

of taking off line rather than getting into detailed answers here.

CHAIRPERSON NICHOLS: Okay. Do we have an actual time when we have to end?

MR. TANTON: Yes.

(Laughter)

CHAIRPERSON NICHOLS: Tomorrow? Midnight? This was scheduled to go to 5:30. I'm sure many of us would be happy to stay at least a half an hour longer if that's necessary to also allow for public comment.

DR. KEVIN KENNEDY: And actually we will also start passing out another set of cards for people who feel like they also want to have a chance to get up and speak themselves. And then we'll collect those.

But hopefully these will take care of most of the questions and concerns folks had.

CHAIRPERSON NICHOLS: Let's hope. Okay.

PROFESSOR GOULDER: Okay. The first question is by Ray Williams from Pacific Gas & Electric. The question is directed both to Dave Kennedy at ARB and Paul Bernstein at CRA.

The issue is:

> How did you model cost and emissions reductions for complementary measures specifically in scenario 1 versus

scenario 5?

So I think it's important first to explain what the two scenarios are and then be specific about how the complementary measures were modeled.

David, do you want to go first?

DR. DAVID KENNEDY: Okay.

So the cost of complementary measures, how they were modeled is going to be different depending on the measure. Cost . . . Okay.

Scenario 1 versus scenario 2.

PROFESSOR GOULDER: 5.

DR. DAVID KENNEDY: Should be 5 okay.

So in scenario 1, we assumed that the targets expressed in the complementary measures were fully met or at least met to the extent that the model could find them.

An energy efficiency measure, what we did was essentially treat it like a standard where we increased the marginal efficiency of new devices that would flow into the economy, and with that increase in marginal efficiency came an increase in the cost of the device and an estimate of the fuel used by the device. So that would be similar for the vehicle strategy also.

And I think those are the only two that dealt with efficiencies.

For renewable standard, we built renewables pretty much in the manner that's expressed in the July PUC report using the costs that were used in that same deliberation.

For the CHP, we set a target for 30,000 gigawatt hours, but the model did not find that amount of CHP available. So quite a bit less was actually found. The cost of that dealt with the cost of the equipment necessary to do the CHP.

For the VMT measure, we actually do not have a cost estimate for that in 1 which is why it's excluded in Case 3 and Case 5 so what we are looking at is basically disinvestment in vehicles and fuel from a reduction in VMT.

Am I out of complementary measures yet?

Oh, LCFS. Yes. LCFS is strictly we require a percentage of the fuels in California to be made up of biofuels, and they come at an assumed price.

DR. KEVIN KENNEDY: Paul?

DR. BERNSTEIN: Okay. So specifically kind of a simple answer to what's the difference between 1 and 5, the only change -- essentially, the only change in the model is that we reduce the stringency of the various complementary measures.

So for example, if we take the RPS in scenario

1, it's meant to be a 33 percent RES, and it's basically modelled as the model chooses the technologies, the least cost technologies to meet that 33 percent RES and actually could exceed the 33 percent if it proved cost effective at the prevailing permit prices.

Then in scenario 5, that measure was removed and we just have the 20 percent RPS. And again, the model is allowed and in fact we find does actually slightly exceed the 20 percent RPS so it's a minimum constraint.

Likewise with the others would be, the LCFS, instead of scenario 1 you have to be 90 percent as energy intensive as conventional fossil fuels -- or current fuels.

And in scenario 5 you have to be 95 percent.

But again, the model, if it found that it was cost effective to do so, could exceed that 95 percent.

PROFESSOR GOULDER: Okay. Dave Kennedy, we've got another question, a very specific one, for you from Jim Lazar from Microdesign Northwest. The question is:

> Are energy efficiency measures required by AB 2021 and VMT measures required by SB 375 imbedded in the reference case -- that is the Business-as-Usual case -- or are these in the AB 32 policy

implementation case?

DR. DAVID KENNEDY: I'm not sure what's required by AB 2021, but the energy efficiency and the VMT measures are in a policy case, not the reference case.

So I'm not sure if 2021 would include efficiency that is built into the IEPR baseline forecast. Could someone help me on that one?

DR. KEVIN KENNEDY: I'm not sure either offhand, but I do -- I think that the relevant point is that the energy efficiency included in the reference case is the energy efficiency that was included in the Energy Commission's demand forecast and includes, I believe, just what is currently committed from the existing utility programs.

And my guess is that there's a portion of what's required under AB 2021 that is incorporated into that, but as you look past probably about 2012 very little from 2021 is incorporated and it would be in the policy case instead.

PROFESSOR GOULDER: One of the things the EAAC said in our appendix is that we thought an attractive feature of ARB's work was they spent a lot of attention and effort to try to get the Business-as-Usual case right to include those policies which would be there

under Business-as-Usual and to put in the policy implementation case other policies that wouldn't be there.

That was a criticism of the earlier work by ARB, and I think they responded pretty well to that. At least that was the view of the committee.

Here's another question for Dave Kennedy from Hank DeCarbonel from Concrete Pumpers of California, a quick question:

> Please explain the difference between GDP and SDP and CARB SDP.

DR. DAVID KENNEDY: Well, gross domestic product is usually reserved for the product at the national level, while state domestic product or GSP would be reserved for the product at the state level.

I'm not sure what separation with CARB SDP would be.

(Comment off the record)

DR. DAVID KENNEDY: And the measure of GSP also includes taxation along with value-added if I'm remembering correctly.

(Comment off the record)

DR. DAVID KENNEDY: GSP measures the value at -- the returns to labor and capital in the state plus taxes plus -- somebody else help me out here if they

know off the top of their head the definition?

CHAIRPERSON NICHOLS: The question I guess would be did you create some new category that hadn't existed before?

DR. ROLAND-HOLST: It's the counterpart of GDP at the national level.

(Comment off the record)

DR. ROLAND-HOLST: That's GDP accounts. They include taxes.

PROFESSOR GOULDER: Okay. We've got a lot of questions so try to move --

DR. ROLAND-HOLST: Only producer taxes, value-added, right? Producer taxes. Not income taxes. Producer taxes and factory taxes. Does not include household taxes.

PROFESSOR GOULDER: Okay. We have a question from Jason Orta of California Workforce Development. His question, which could apply to any of the modelers:

> Have any of the analyses looked at the effects of AB 32 on wages if we switch from carbon-intensive fuels to a less carbon-intensive economy?

So in other words, what's the effect of AB 32 on wages, allowing for the compositional changes in the economy? Anyone want to report the results in their own

model?

DR. BERNSTEIN: I don't have them offhand, but we certainly do -- I would think all the models do. I mean there's an equilibrium wage rate. There's a wage rate, and we have a change in that. I don't know what it is off hand, though.

PROFESSOR GOULDER: Can you tell us the direction?

DR. BERNSTEIN: Down. In all the policies, it's down. I mean the wage rate declines under all the policies.

DR. DAVID KENNEDY: I think I would -- off the top of my head, I see slight increases in the wage rate across the board.

PROFESSOR GOULDER: I think this is also consistent with the difference in employment effects.

What you get -- I think it's because of differences in labor intensities --

DR. DAVID KENNEDY: And also I think because of migration. We actually keep people from migrating into the state which has the effect of driving wage rates up.

PROFESSOR GOULDER: Right. So that's an important difference between the CRA and ARB analyses in terms of the effects on wage rates and on employment, although the effects are pretty small in either

direction. Okay.

James Fine from EDF, Environmental Defense Fund, refers to the issue of price volatility. He would like to correct the claim that allowance price volatility is a real problem.

And so perhaps someone could perhaps comment or weigh in on the question of whether it's a real problem or not.

And I think one has to recognize whether it's a problem or not will depend in part on policy design and whether there's such a thing as a safety valve or price ceiling established.

MR. TANTON: That's what I going to say, Larry, exactly. As I heard it, and I think as I spoke it, it's a real concern. That's different than it is a problem.

It's something we need to pay attention to in promise design and mechanism design and evaluation.

It can be a problem. It has been a problem elsewhere. It's not necessarily a problem if we keep our eyes peeled.

DR. BUSCH: Dr. Fine showed me his graph that he references, and he basically compares volatility in the EU market where there are not price collars to volatility in gas and oil markets to show that, you know, there's volatility in markets, and the volatility

in the price of carbon has been less than these other markets.

PROFESSOR GOULDER: What markets is he comparing with?

(Comment off the record)

DR. BUSCH: Coal, oil, and gas commodities, Dr. Fine says.

PROFESSOR GOULDER: Okay. Thank you, Chris.

This has become a judgment call in some sense, whether you consider a certain amount of volatility large or small. But at least there are a lot of folks that are concerned enough that they feel the appropriate policy should have a price ceiling or safety value.

MR. TANTON: It's not just a price ceiling.

Keep in mind, particularly with respect to banked permits, there's the issue of potentially stranded assets, devaluing something you've already paid for.

PROFESSOR GOULDER: Can you elaborate on that?

MR. TANTON: Suppose I bought at auction a permit for 2012 at $100, and the price plummets in a future year. I have now a stranded asset.

PROFESSOR GOULDER: So you're suggesting you would favor both a price floor and ceiling?

MR. TANTON: That's why I suggested a collar.

As one mechanism.

PROFESSOR GOULDER: Right. Okay.

DR. BERNSTEIN: I think there's some industries that actually kind of monthly volatility is an issue, and then there's also an issue of, I think Tom's getting to, having some price certainty is important to some industries when it comes to long-term planning.

PROFESSOR GOULDER: We've talked a lot, and perhaps more than we want, about market failures.

But here's a question that I guess we need to respond to. It's from Ralph Moran at BP America. He's asking for clarification about what market failure each complementary is designed to address and how this addresses it.

Now I think it's true that we have been somewhat vague with perhaps some exceptions about the market failures.

I could mention one. And that's the principal agent problem or the problem that occurs in rented buildings.

There is a market failure in that if the building is -- the tenant may not have a direct incentive to reduce energy use or electricity use if that's -- if he's not paying for the amount of variable costs based on use if it's somehow built into the rent

already.

And that means that Cap and Trade to the extent that it raises electricity prices may have a muted effect on the energy use by a renter.

There's sort of a gap between the incentives of the policy and that's ultimately felt by the consumer.

So a complementary measure in this case would be a building efficiency code which requires that insulation be put in to help reduce energy needs rather than operate on price basis.

Michael?

DR. HANEMANN: So first of all, there are a lot of rented commercial buildings. In other words, if you just think this is apartments and how many apartments in California. Many commercial buildings are in fact rented.

And a second element is for homeowners on the residential side. There a perception that if you invest in improving efficiency you won't get this back when you sell the house.

And there was a very interesting study done about 20 years ago of house price, what's called a hedonic study, what prices houses sell, which in fact found imperfect capitalization of energy efficiency investments.

So this is sort of an issue that's wider than just the number of homes in California, the number of households that rent.

CHAIRPERSON NICHOLS: My understanding is that commercial buildings in California, except for those that are brand new, almost never are sold because of Prop 13. They would get reevaluated and retaxed at that point.

So I guess that leads to sort of a general comment that I have that I would love to hear addressed which is: This kind of assumption when we're talking about models, that you're living within a closed universe, and even though at the end of your comments several of you did talk about policies outside the design of the Cap and Trade program or outside the AB 32 program as it currently exists that could be used to address some of these issues, one of the things that I think makes the public discourse on this so difficult is, just as right now, the moment anyway, I'm finding that many people don't actually know what is in AB 32 and what isn't.

And therefore because it's getting all the publicity it's assumed that everything people are mad about with respect to government regulation or at least environmental regulation is somehow part of AB 32.

But the other side of that is that a lot of the things that people are unhappy about in our state, the quality of the schools, the quality of the infrastructure, you know, the budget situation, are truly not within the scope of AB 32.

And yet without addressing some of those issues, we may not be effectively able to just make all the other issues go away.

I mean the questions that have been asked about wage rates, for example. Well, you know, if somebody is installing a new pump at a gas station and that pump is going to have biodiesel instead of regular diesel, or some other alternative fuel, there is no difference in the work of the construction worker who is actually putting -- or the pipefitter who is putting that new pump on the island.

In fact, it's just a good job, something he could attribute to our program.

On the other hand, if people shift away from materials they're using now that are being produced in places that are unionized and have high wage jobs, and new solar plants are not hiring people at union rates, then there's -- that's a loss.

Now how does AB 32 either make that happen or not make that happen?

I mean the changes are going to occur, I believe, regardless actually whether AB 32 exists -- other policies of the nation and the state eventually are going to cause us to shift -- we're already clear we're moving in the direction of more renewables whether there ever was a carbon program.

And yet again just within the four corners of these models, AB 32 or the Cap and Trade program takes the hit for this -- these bad shifts that are happening.

So I guess that's a kind of a general question about models and what can we do with that.

PROFESSOR GOULDER: The shifts are happening already, say under the reference case or Business-as-Usual case.

But another question is, how much is the further change that is occasioned by AB 32?

So the models try to get in the reference case under the baseline the shifts that are already happening to get them to some degree.

But then in addition, they try to say how much do you depart from that baseline when you introduce another change to the policy environment?

And as we saw, we have a difference, for example, between the ARB results and the Charles River results that partly maybe due to differences in assumed

labor intensities of the different industries that are contracting or expanding.

There's other reasons as well as David indicated.

So I think the models do attempt to get at that, both in the baseline and in the policy change cases. But that's the good news. The bad news is they sometimes come up with different results.

However, I would emphasize again that the impacts on employment tend to be pretty small. So even though they differ, they don't differ by a wide amount in terms of aggregate employment.

CHAIRPERSON NICHOLS: Okay. Thanks. I think you have more questions?

PROFESSOR GOULDER: We have lots more. Tell us when we have to stop.

Okay. Here's a question for Paul Bernstein from Norm Pedersen from Hanna and Morton, LLP. On CRA slide 4, there's four percent offsets that lowers the permit price by 33 percent. The question is:

> Why would going to Waxman Markey reduce the permit price by another additional 33 percent?

DR. BERNSTEIN: I'm not sure if the question is thinking that we have a constant of 33 percent in our

model. But we don't. The numbers just work out that way.

I mean I think the main take away from the issue is just adding more offsets reduces the cost further. So having more -- I mean, as I said, it just happened to work out that it was symmetric there.

PROFESSOR GOULDER: Okay. And a question now, David -- it says:

> David Roland-Holst suggested an additional 4 percent energy efficiency is needed. Where is this anticipated to come from if the current policy is 100 percent of the effective energy efficiency?

DR. ROLAND-HOLST: I don't completely understand the second half of the question, but I have to apologize if the slide wasn't clear.

It's a 0.4 percent per year, a much smaller energy efficiency increase. And it's actually consistent with the State's 30-year experience with energy improvements.

PROFESSOR GOULDER: Well -- okay.

DR. ROLAND-HOLST: There's more on mine. Do I answer it? This is from Hanna Morton, and it says:

> Roland-Holst and Bernstein provide

diametrically opposite results.

Certainly there's some disparity in our results, but I was surprised how congruent they are. I mean they are the same in sign in many cases, but the difference in magnitude is tenths of a percent.

So I don't really have much to say there except that we've already spent a long time talking about those differences.

PROFESSOR GOULDER: This could well be a question that requires a long answer, so I encourage answers that are short. It's from Frank Harris at Southern California Edison:

> Presentations today are highly driven by input assumptions. How would or should ARB design its approach to facilitate such compliance?

DR. BERNSTEIN: I think that gets back to what I was trying to say before that we don't really know how technology will be. We don't know how the economy is going to grow.

So again, beating a dead horse, flexibility is important.

So whether that's, you know, sorry to introduce the controversy over RECs or whether there's some kind of, with LCFS, if there are tradable credits, if there's

some kind of price cap on those credits, if the fuels prove to be difficult to come by.

We've heard about price collars. I think those are a good idea.

I would also advocate that there's a decent amount of offsets available, and that's how, you know, some approaches to deal with all the uncertainty.

PROFESSOR GOULDER: We have a question from Bonnie Holmes-Gen from American Lung Association of California, or ALAC.

Question/comment is: She recommends that CARB include a fuller accounting of co-benefits, air quality, public health, and other co-benefits, from climate policy in the economic analysis.

She refers to Roland-Holst's 10 billion in ozone related illness -- $10 billion I suppose -- in ozone-related illness and death.

Is that under the baseline?

DR. ROLAND-HOLST: That's a completely different study of climate damage.

PROFESSOR GOULDER: But the question then is:

> How will CARB build this element, namely these co-benefits, and quantify the co-benefits into the analysis going forward?

So it could be Dave?

DR. KEVIN KENNEDY: One of the things that we did do as part of this analysis was look at the reduced cost for otherwise reducing the criteria of pollutants.

I'm sort of trying to move to something where you would actually be -- and Michael may want to jump in when I'm done -- that it's very difficult to sort of take the sort of changes you would see from the climate policy and quantify that into actual public health benefits.

We are doing some work with the Department of Public Health to try to get a better handle on the health -- doing a health impact assessment around the Cap and Trade program and understanding those sorts of changes.

But whether those can be quantified in a way that can be readily fed into the economic model is another challenge.

DR. HANEMANN: I just wanted to say that this is what Smith and Carbone have done.

And what -- quickly. There's the issue of data, but there are also methodological issues including particularly calibrating what's called the utility function underlying the analysis.

They came out with a way to do the calibration

if you have data. And so it's sort of another level of model building.

But it's doable, and obviously you want to choose some impacts that are very important and there's a lot of data at first, and then later on add on other things as time passes.

MR. TANTON: If I could add, I think it's important to keep in mind that any monetization of those benefits be done using avoided damage function rather than supply curves or cost of control sort of curves.

Reminds me of a model developed at the Energy Commission back around 1985 called air quality evaluation model that monetized based on how materials effects the avoided damages from a marginal change in NOX and SOX and et cetera.

And I think that methodological approach is much more sound than a cost of control approach because it actually measures the avoided damages.

PROFESSOR GOULDER: Here is an important question, and we're going to have to ask the author to identify him or herself.

It says:

> The analysis lacks -- it's referring to ARB analysis -- the analysis lacks a discussion about the near-term impact on

the California economy. If industry is to innovate, how will industry be impacted in the earlier years, particularly taking into account consideration of California's current downturn and industry's limited access to capital?

And now I see the author is the Brenda Coleman from California Chamber of Commerce.

David?

DR. DAVID KENNEDY: While we don't present any near-term macro results, they would largely be similar to what you're seeing in later years.

Permit prices are low in early years which would require very little to have to be done.

Implementation of any of the complementary policies are also phased in over time so there are not a lot of investments happening early on.

In the chapter in the report, I do show how investments phase in over time. And while I think we might have something to show how prices grow over time, early-year impacts should not be expected to be anything large.

DR. ROLAND-HOLST: I'll speak very briefly to that.

The policies at the moment are progressive, and I think the adjustment process will be likewise progressive.

PROFESSOR GOULDER: You mean increasingly stringent?

DR. ROLAND-HOLST: Increasingly stringent.

But gradually. They'll be gradualist policies, let's put it that way. May be more appropriate.

But for the innovation scenario, I also made that essentially a gradualist innovation process, although I didn't model the innovation process endogenously. I specified that as a scenario.

But there is a very interesting question particularly if we see economic gains in some of these policies at the end year. And that basically has to do with borrowing from the future in order to finance some of these adjustment policies.

And there's some really interesting possibilities there that we haven't even begun to look into those mechanisms.

DR. BERNSTEIN: I think that all the models though may have a shortcoming when it comes to really looking at the near-term impacts when it comes to investment.

I think the CRA model, for example probably --

I'm sure it doesn't have enough detail to really look at what needs to take place in terms of investment and new technologies and what have you to start meeting some of the regulations.

DR. ROLAND-HOLST: Not only that but some of these investments are lengthy. In the power generation sector, you're talking about 30-to-50-year commitments of very large irreversible capital goods, so this is something we need a little more insight to.

DR. HANEMANN: And this is what I was getting at by saying that these are equilibrium models and they don't deal with speed of adjustment or cost of adjustment.

And so there are two pieces.

I think there should be some attempt to think of these factors and put in, as it were, diffusion curves or get some idea of what about.

And the other side of that is designing policies which give some degree of flexibility.

I just want to add one other thing with flexibility. There's flexibility and flexibility.

What I mean is some flexibility can be gamed.

If you have automatic -- certain automatic adjustment rules: If I know something is switched off if the price hits, you know, 12 dollars.

Let me put it that way. There's some experience with commodity prices. There's a famous story of Gallo buying -- contracting long-term contracts for wine grapes, but it was triggered to a particular price and particular market.

If you could push the price over a threshold, maybe for an hour or two on a certain day of the year, you switched off.

So my point is that the mechanisms, whether a collar or other things, need to on the one hand provide flexibility, but they need to be designed so they're not so predictable that they can be gamed.

That's all the more reason why it's important that CARB get on to that phase.

PROFESSOR GOULDER: Here's an important question about flexibility, but it looks like it applies more to the policy itself than to the modeling. It's by Frank Harris again from Southern California Edison:

> It's clear from the presentations given today that the results are driven by the input assumptions. As a result of this assumption sensitivity, some of the reports recommended that the programs be designed, the policies be designed to include or facilitate some level of

flexibility. This would be a recognition of the potential that the assumptions may be wrong. The question then is --

And I think that is a correct depiction of what's in the EAAC report, for example, emphasis on making policies flexible, acknowledging some of the gaming issues you mentioned.

So the question then is:

How would or should the ARB design its approach to facilitate such compliance?

Now it sounds to me like this is a question about the policy design as opposed to the modeling, but if anyone wants to take it, or anyone on the Board wants to take it, that would be fine.

Anybody?

MR. TANTON: I think we want to do good and avoid evil.

CHAIRPERSON NICHOLS: That's good.

I was just going to say that AB 32 has written into it a five-year mandatory review of the Scoping Plan as well a Scoping Plan itself which is not -- would not have necessarily been assumed to be something that you'd have to have.

And I believe the reason for that is the recognition that we don't know everything we need to

know sitting there today.

It's hard enough to predict what the economy will look like in 2020, much less in 2050 when most of us are not likely to be here to find out whether we were right or not.

So the only thing you can do is to take this in in pieces and try to look at it every few years and see if you're taking advantage of what you have learned.

We've already learned in the short period of time since AB 32 passed that projections about Business-as-Usual weren't correct.

Nobody, with all respect to the economics profession, predicted the extent of the recession at that time.

And that's left us now with some -- in a helpful way, I guess -- with some room to ramp up the program a little more slowly if we want to do that in order to take account of uncertainties.

But this is the kind of thing that I think we have to assume, not recessions perhaps, but, you know, unprecedentedly severe recessions, breakthroughs in technology, changes in global patterns of development, et cetera, that we can't really know.

DR. NELSON: I think that's a really important point. And there's a big literature on adaptive

governance which is essentially what you just described.

One of the hallmarks of adaptive governance is essentially decentralization of decision-making down to the local level.

And, you know, I think in the larger climate change kind of social science research indicates that climate policy is an elite debate and citizens in fact don't understand it, as Chair Nichols expounded on.

And so I think it's important to get, you know, the outreach mechanisms and stakeholder involvement at the local level going forward in order to help answer some of the questions about what is, you know, is this okay what we're doing, and how should we do things differently?

PROFESSOR GOULDER: So at this point, we've gone through all the cards that have come in.

I just want to make one quick comment, if I may, about uncertainty and modeling.

I think we focused a lot on the limitations and the blemishes in these models. My view is that there still is a lot of information that comes out of them.

For one, in calibrating the models and trying to build in the behavioral parameters, building the data, there is a lot of information that goes into that. It's not entirely arbitrary.

There is uncertainty, but there's a lot that goes into the model that's based on good empirical evidence and good research.

Yes, the models differ, and there's also a lot of range of uncertainty about parameters.

There as Tom Tanton indicates, we can deal with that -- a highfalutin way of dealing with that would be through a Monte Carlo approach where you just randomly let all the parameters vary according to some distribution.

But I think that the ARB and Charles River have already done a lot in that spirit, which is to do fairly broad sensitivity analysis.

One thing that I take from it is that even if you look at the range of results under these range of scenarios, they are not all that far apart. So I think that helps build confidence.

So I guess this is more of my own personal view that we should feel at the end of the day that we're getting some useful information out of these models, that the uncertainty shouldn't be so daunting as to make us throw up our hands and say we haven't learned anything.

But that's a personal view.

CHAIRPERSON NICHOLS: All right. I think I've

seen quite a few cards making their way to the floor of people who want to stand up and have their few minutes at the microphone here. Okay.

So I don't need this list printed out unless you need to. Just bring me the cards, and we'll call on folks.

DR. KEVIN KENNEDY: Actually, I think there may be one or two questions we --

CHAIRPERSON NICHOLS: Okay. Why don't you go ahead.

DR. KEVIN KENNEDY: I'll go ahead, and -- one from Dorothy Rothrock from CMTA regarding tracking leakage going forward.

Will we be doing this? And also wants everyone to know she has a slide to share that shows site selection in California already.

DR. ROLAND-HOLST: Is that a question to Reid?

MR. HARVEY: It's directed at me, I guess, or is it directed at California? That's the question.

DR. KEVIN KENNEDY: Was it -- anyone can take it. We were trying to do some initial sorting of who we thought the questions were most appropriately directed to.

MR. HARVEY: I'll take a stab from the national level and see if that's sufficient.

So at the national level, we have substantial trade data that we collect already through the economic census. EAA collects data. We use those data in the report that I mentioned that we released back in December.

If I can, I'd just like to restate the bottom line of that report which was that we found very little initial leakage to other countries that were not taking on caps that were about ten million tons a year, that the vast majority of emissions reductions achieved by energy-intensive industry under the Cap and Trade program are from reductions in the emissions intensity of production as opposed to things like increased energy efficiency, as opposed to decline in production, such as increased imports from unregulated countries.

Nonetheless, I think we have a good body of data already to understand trade and emissions.

If there is national legislation passed, we would have additional authority to do this because there would be an output-based allocation system that would require that we implement this allocation system based on very detailed data from these firms.

So that -- that's the national perspective.

CHAIRPERSON NICHOLS: I have a slightly different question if I may build on your question. Do

you mind?

Several years ago, there was a report that was done by a commission in Great Britain that was under the name of Sir Nicholas Stern in which he argued, and I heard a presentation on this, that failure to deal with climate change was going to lead to another kind of disastrous global economic impact which was that people in those poor parts of the world who are in theory at least in the future going to be the market for all the things that we are going to be producing, whether it's food or cellphones or whatever, would now be homeless refugees or, you know, you can paint out the scenario. For some of these countries, it's really terrible.

And therefore that the global economy as a whole was going to suffer, including wealthy nations which would suffer because of their inability to export to these places.

And I think that report was widely criticized, and it was -- I don't know if it's still considered valid or not.

But that particular issue just seems to have kind of disappeared. So we're not just talking about whether California or the US alone, you know, could do okay if we start limiting our emissions.

This is sort of a different question that

assuming that the world is going to be going through changes that are already underway, to what extent is that going to also be having an effect that we should be building into our model?

MR. HARVEY: That's right. We have an interconnected global economy, and the health of our trading partners has an effect on us as well. And so the impacts of climate change on our trading partners will certainly have an effect on us as well.

DR. HANEMANN: I was in a conference yesterday with a good friend of mine, Dale Whittington, from North Carolina who is working as part of a group to try and sort out the Indus River system and the Ganges Basin Plain is one of those areas, I think five hundred million people, and significant risks of flooding in the event of climate change.

And so, you know, when people talking about water wars in the future and immigration, whatever, in many areas that's sort of exaggerated.

But there are vulnerable areas, and that's one and not the only one. But that's a real issue depending on how quickly you get climate change and how severe the effects are.

So it's an -- it's a real issue.

CHAIRPERSON NICHOLS: The reverse of

competitiveness.

DR. HANEMANN: The good news is instead of making the cellphones, they'll be on our doorstep.

PROFESSOR GOULDER: I think this actually --

MR. TANTON: Chairman Nichols, if I could add a little bit to that.

CHAIRPERSON NICHOLS: Sure.

MR. TANTON: It is crucial that we keep the rest of the world in mind. We often hear, you know, the United States has five percent of the population and 20 percent of the emissions.

That's true.

But we're also responsible for 30 percent of the world's GDP. We're feeding them. We're giving them cellphones. All this other stuff.

We heard earlier about our emissions intensity. Our emissions intensity had been on a three-decade improvement. We're getting better at feeding and clothing the rest of the world, and we need to bring them up to our standard.

CHAIRPERSON NICHOLS: I understand.

PROFESSOR GOULDER: I think this connects with possible ways that ARB moving forward can improve its modeling.

We mentioned how the model is California

oriented, doesn't deal with leakage.

But this offers a second reason which is that to the extent that California takes action, it avoids damages elsewhere and avoids reverberation of costs to California.

So I would hope that over time the ARB can expand its analysis. Now going all the way to a global model may be overly ambitious, but at least bringing in a little bit more regional detail beyond California might be a good investment.

DR. ROLAND-HOLST: Let me just follow up with a question I'd like to pose to basically -- I guess I would pose it to the Board.

And that is: Beyond the mitigation agenda, as we call it, which is dealing with emissions and greenhouse gases, there is a looming and vast agenda which Chairman Nichols has referred to which is the adaptation agenda.

California cannot stop climate change alone, but we have responsibility to protect ourselves against its consequences.

And I've been involved in studies of those impacts. You've been involved in big studies of those impacts.

And believe me, we're not talking about our

great-grandchildren's life experiences. This will happen in a matter of a few decades. We'll begin to see this.

But we're fortunate in California because in poor countries' climate adaptation will be about protecting people. In the wealthier economies, it will be about protecting assets.

Because we have the resources to adapt, all we need is the foresight to do so. And I would liken it to trying to steer a supertanker to avert a distant collision.

If we start now, this will be something that we can probably come to terms with.

But we've got to begin to take action because these are infrastructure decisions that have lives of 50 to 100 years.

And in my talking around the state about these issues, I have one frustration I think, and that is that people haven't internalized this risk the way they have internalized a seismic risk.

That's something we get gentle reminders of in the west cost in the middle of the night a few times a year. For that reason, we're building a new bridge in the San Francisco Bay before the other one falls down because we know that risk is real.

Now we acknowledge that.

I'm very concerned that the state really needs to begin to look towards that horizon and think about the adaptation challenge in a way that begins to use very large recurrent budgets for infrastructure in a way that can help minimize the long-term costs.

CHAIRPERSON NICHOLS: Good point.

There is a blue ribbon commission under way that's working in parallel with the state's climate action team that's collective bargaining agreement action team that is at least coming up with an assessment of this problem.

I think it's directed at coming up with a report by the end of the year to recommend specific policies for legislation and for the next administration for just the reasons that you're saying.

Because even in bad times, we are spending money on infrastructure but we're not necessarily spending it with climate in mind, and that's definitely something that has to be corrected.

Okay. Are you done or do you still have further --

DR. KEVIN KENNEDY: I think there's just one more from the cards we collected.

This was from Obadiah Bartholomy from the

Sacramento Municipal Utility District:

Assuming that out-of-state reductions whether in the form of offsets or allowances are less expensive but return limited value to California, how much more could we justify spending for in state reductions given the value would flow back into the state's economy?

And I'm guessing there's not a short answer to this question. But I think it's useful to sort of see if there's any short initial responses from any of the economists.

DR. BERNSTEIN: Can you say the question one more time?

DR. KEVIN KENNEDY: The basic idea as I'm understanding it may be -- you may be able to find less expensive reductions out of state, but the money flows out of the state.

When you're paying for the reductions in state, the money stays, so how much more can you justify essentially spending the money in state in order to get the reductions and keep the value within California?

PROFESSOR GOULDER: Well, there's such a thing as balance of trade and -- or balance of payments. And it's the old mercantilist idea which has been debunked

by economists that says that spending in state is necessarily better than spending it out of state.

Money spent out of state become income to out of state residents which ultimately flows back to California.

So I would question the premise of it.

Now that doesn't mean that offsets or out of state options are all going to be good. But if they are real good, I think we shouldn't worry about them simply because it's a flow in one direction out of the state because that's going to be compensated by a reverse flow from out of state.

BOARD MEMBER TELLES: Could you explain how that revenue will return to California? Especially if we have products which are more expensive? Who is going to want to buy them? A simple way of looking at it.

DR. BERNSTEIN: I think that's almost to Larry's points, right? That by taking advantage of these out of state offsets, the price of California goods will not rise as far. So you'll lose less is one avenue, also you lose less.

BOARD MEMBER TELLES: That's predicated on the fact that the rest of the country is doing the same thing. But if we're doing this and only doing this, I can't see how our cost won't be --

DR. BERNSTEIN: I'm sorry. I'm talking about if you take the situation that the person with the question brought up, you have the situation, one, where you only purchase in-state offsets, and so you'll have a permit price of let's say $50.

If you're allowed to purchase them out of state, you'll have a permit price of $25.

BOARD MEMBER TELLES: I understand what you're saying. I'm saying if only California does this, we have a price, a negative price --

DR. BERNSTEIN: But you'll have less of a negative price.

BOARD MEMBER TELLES: I know, but you'll still have a negative price. And how are you going to get the money back? And why would they buy California products when the products from California, because nobody else is going to be doing this, is more expensive?

PROFESSOR GOULDER: For the same reason that there's a balance of payments identity at the global level. It also applies in California versus the rest of world.

It's a little hard to do without graphs and things like that.

But how about this. Suppose that California is producing $100 billion worth of goods, and it's all part

of income in California, so that's value of the goods and value of the income.

Suppose the rest of the world's also doing a hundred billion.

But now California wants to take some of its hundred billion income and purchase goods out of state.

There's still only a hundred billion of goods produced out of state, so adjustments are going to be made so they're going to now shift their consumption toward California's hundred billion.

Sometimes the overall income and the orientation of consumption has to match where the production occurs. So it has to come back to California.

BOARD MEMBER TELLES: If I was out of state, I would say thank you and then I would spend my money someplace else where I could get a cheaper product.

PROFESSOR GOULDER: Okay. Well, we'll have to leave it at that.

DR. ROLAND-HOLST: Could I jump in just a little bit. I'm not going to try to decide this issue. And in fact, I think that the question actually raises a very interesting agenda for trying to assess the net benefits of offsets.

There are two aspects of offsets that I just

want to mention because I'm not exactly a fan of offsets. If California participated in a national program, I'd be very congenial to that.

But otherwise, I see offsets as a way of denying California its own invention potential. You want to outsource efficiency gains to China?

I mean let's subsidize the China to invent these technologies? Why would we want to do that?

On a purely finance basis, yes, it would be cheaper to reduce carbon pollution in China than it would be in California. But we would be essentially providing incentives for the Chinese to develop technologies that we might ourselves like to develop.

So we need to think about these issues.

I agree that mercantilism doesn't work in the aggregate, but there are these aspects of investment in innovation, not outsourcing pollution.

And the second dimension of offsets I'm worried about is local pollution. Criteria pollutants.

We're going do to less mitigation in California. That will -- may not have a net effect on greenhouse gases, but it will mean more local pollution in California for sure.

CHAIRPERSON NICHOLS: Okay. I have a few cards here. People who also to want to stand up and speak, or

at least said they did at one time. You don't have to if you don't want to.

We would like to hear from you. We really would. Jim Lazar from Burbank Water and Power.

MR. LAZAR: Good evening, Madam Chair and Members. My name is Jim Lazar. I'm an economist and consultant to Burbank Water and Power.

I had actually asked to be a panelist and have followed almost everything that's been said today; but given the time limits, I'll confine myself to two narrow issues.

First, the economic analysis does not have any regional analysis. Given that the conclusion is that there's essentially a zero net impact, there are going to be regions that are winners and regions that are losers.

My hypothesis is that urban regions will do better than rural regions and that northern California will do better than southern California.

But actually, answering that question involves more than just a hypothesis, and I think it would be useful for the State to have some regional analysis.

The second topic I to want address is one that Dr. Sperling raised in his questions to Dave and Paul regarding complementary measures.

The economic analysis bundles together some complementary measures that are required by existing law other than AB 32 with those that are not a factor or part of the Scoping Plan and would be required as a result of adoption of the Scoping Plan as it's now drafted.

On page 2 of my written comments, table 1, I have a table called Cost Effectiveness of Complementary Policies, and I've taken seven categories that were -- six categories that are listed there.

And I added the annualized capital costs to the annualized fuel savings or costs and come up with the sum of annual costs, divided those by the tons of emissions reduction to get an index of relative cost effectiveness.

And this is a pretty simple and crude tool, but there are some that have negative costs and some that have positive costs.

Those that have negative costs, I think Dr. Roland-Holst and Dr. Bernstein would agree if a complementary policy mandate accelerated those and pushed past market barriers to achieve greater achievement of those, it would be beneficial to the economy.

And similarly, I think they would both agree

that if complementary policies mandate, require things that are more expensive, it might not have such a positive impact on the economy.

So in table 2, I actually bundled these into those that are required by other laws, specifically AB 2021 which mandates the energy efficiency investment and Senate Bill 375 which directs the VMT reduction measures, as those will happen with or without AB 32.

And those have together an annualized benefit to the economy of over $12 billion a year based on the numbers that are in the revised economic analysis.

I have then bundled together the other measures that would be imposed by the Scoping Plan and if AB 32 were suspended by the voters, by the governor, by the courts, would not be in effect. And those taken together have a negative impact.

I would urge the Board to make one fundamental change here which is to require that those measures that are required by AB 2021 and SB 375 be moved out of the implementation cases where they are now and into the reference case because if the Scoping Plan doesn't go forward they are scheduled to happen anyway, and they belong in which reference case.

I would also urge ARB to direct the staff to perform some regional analysis of some kind.

CHAIRPERSON NICHOLS: Thank you. Norman Pedersen, and Obadiah Bartholomy.

MR. PEDERSEN: Good evening, Chairman Nichols. I am Norman Pedersen for Southern California Public Power Authority.

CRA has said there a cost to complementary measures as opposed to the pure Cap and Trade approach. We actually question CRA's calculation of some of the cost of -- some of the measures they talked about.

I think I had heard Mr. Bernstein say today for example that the cost of alternative fuels under LCFS would be 2.5 times the cost of conventional fuels.

That isn't in his written materials, but we question that being aware of what the ARB staff has said on that point.

Nevertheless, beyond that, we are willing to say there is a cost to some complementary measures, and that the cost will be high, and that it will be a societal cost.

We are very familiar with the sort of marginal abatement curves that Professor Nelson showed you today.

Some of the measures that the electric utility sector will be pursuing are going to be very high on that marginal abatement curve.

In the 33 percent RES proceeding you have

underway, ICF is projecting that by 2020 the RES cost will be approximately $3.5 billion a year and raise electric rates by about 7.5 percent.

Nevertheless, SCPPA supports the complementary measures like RES and we support them for a host of policy reasons.

Our proposal is not to do away with complementary measures. Our proposal is that allowances be administratively allocated to the electric utility sector and to the utilities in the sector for the benefit of electricity consumers to offset the impact of the cost of the complementary measures on ratepayers.

Our proposal is not to abandon the complementary measures.

And one last point that more favorably impressed us in CRA's presentation is the point that the four percent offset limit in the Scoping Plan could reduce allowance prices by 33 percent.

Now it seems that there is something of a rule of diminishing returns. And this is actually the point of my question to you, Mr. Bernstein. There's a point of diminishing returns with offsets.

For example, CRA projects that if you increase the use of offsets at the much higher level that would be allowed under Waxman-Markey, you'd only get another

33 percent in allowance prices, so it does seem there's diminishing returns there.

Nevertheless, we support Mr. Tanton's concept of the price collar, and we support increasing the limit of on use of offsets as way to contain allowance prices if the high end of that price collar were hit while still retaining the integrity of the Cap and Trade cap.

Thank you very much for this opportunity to address you this evening.

CHAIRPERSON NICHOLS: Thank you.

Okay. Obadiah.

MR. BARTHOLOMY: Quite a lot of beeping and whining going on with the electronics here today. Okay.

Good afternoon, Chair Nichols and fellow Members of the Board and all of our wonderful ARB staff and economists who contributed today.

SMUD really appreciates the good hard work that's been done in thinking about how the AB 32 program is going to impact the state's economy, and we certainly support the State's investment in moving to a lower carbon economy and believe it will result in having good green jobs come here to California.

We have a couple of thoughts.

There was a lot of discussion on complementary measures today. And while we agree with Norm that some

of those are going to be expensive and some inexpensive, like Norm and SCPPA, we strongly support including of complementary measures for a couple of reasons.

There was a lot of discussion of market barriers for energy efficiency in particular, and we fully agree that while we'd love it if our customers would just see the cost logic and adopt energy efficiency measures, it actually takes a lot of hard work to get them to do that, and strong programs that we've been developing over the past 30 years.

Another reason that we strongly support complementary measures is because we recognize that we're not stopping at 2020.

It would be great if we could just design a low cost system to get to 2020, 15 percent reduction, and stop there.

But if you actually look at getting to 2050, we're going to need to ramp up programs in renewable energy technologies, renewable fuels, all those things to get to those deeper reductions that we're going to need to hit.

With respect to use of allowances revenue, SMUD agrees in general for the electric sector but really for all sectors that it's essential to invest revenues raised from auction into measures that actually reduce

emissions and contribute to the goals of AB 32 and help us to actually create green jobs in the economy.

As far as the offsets question goes, I think we would agree on the specific looking at the use of expanding offsets in the event that you're hitting the upper end of your cost target range and making sure that you're not penalizing the state's economy too much but also maintaining the environmental integrity of the cap overall through the use of environmentally sound offsets.

Lastly, SMUD believes that the economic analysis of AB 32 would be enhanced with a look at a couple of different policies scenarios.

And specifically, those scenarios could examine costs and benefits associated with higher fuel costs than were in the baseline forecast similar to the costs that the world experienced just a short two years ago.

Finally, we strongly agree with the idea of incorporating technology innovation into scenario analysis to understand what the benefits could be to the state. Thank you.

CHAIRPERSON NICHOLS: Thank you. Hank Ryan? Then Dorothy Rothrock.

MR. RYAN: Hello. My name is Hank Ryan. I'm Executive Director for Small Business California.

Appreciate the opportunity to speak in front of CARB and this panel.

And first of all, we just want to say that very much appreciate this appendix that just came out. It happens to clarify the balance of all the different studies out there.

In fact, as much work as I know it has been, it would seem to be productive to have this perhaps happen again because things will continue to change and build out. It just seems very informative and helpful.

Briefly, I just want to mention something that Chris initially talked about on bill financing and how it can effect all cost effective energy efficiency which is indeed the loading word.

San Diego Gas & Electric's program essentially has grown by leaps and bounds and is retaining a one percent -- less than one percent default rate. And that's being followed by the other utilities here in California.

Because it addresses all incentives that they provide, it is going to be able to reach far deeper into what is going to be the affordable cost effective energy efficiency out there.

We are constrained by access to capital in a huge manner. So on bill financing and property tax

assessment approach for financing I think will really allow us to expand out. We need that very much.

And again, this access to capital framework that we're looking at from small business right now is a real problem.

One thing that was mentioned today had to do with we will be smarter tomorrow than we are today.

And I think we'd all like to believe that, but one thing that was in this appendix was very important for us to read, and that was the reference to the Varshney study.

Because as small business is represented by a variety of entities around the state, one of those entities is the Governor's Small Business Advocate.

And that study is the only study that is on the website for small business to access. And we believe that that's a real serious problem and goes directly to the issues of communication and, frankly, fear mongering that does not help us.

We will not go to invest in efficiency if we're scared. We need to be informed.

So I have asked in writing for that to be taken down or to be matched by complementing studies at the very least. I hope to have a dialogue with the advocate, Small Business Advocate, shortly that will

help that -- perhaps that dialogue continue so that something can happen to that effect, and I just want to make that statement on the record.

Thank you.

CHAIRPERSON NICHOLS: Thank you for your interesting point. Ms. Rothrock and then Ray Williams.

MS. ROTHROCK: Dorothy Rothrock, California Manufacturers & Technology Association.

I'd like to say that we're very concerned and hope that innovation is going to drive job growth and economic success in California; and we're concerned that in fact it won't, at least so far as manufacturing is concerned because of what we're seeing happening in the economy.

And we're wondering about the Business-as-Usual sort of assumptions we may be making.

I've handed out a chart that shows what we're seeing actually on the ground. This isn't a model. This is what Site Selection Magazine has found with regard to where people are siting or expanding manufacturing capacity.

And as you see, of the 25 most populous states, we're way down on the list in terms of new or expanding facilities per one million people.

If you look up above, you'll see that while we

now have 11.7 percent of the US manufacturing workforce, we've only sited 1.5 percent of the new or expanded facilities in this state.

So with increasing costs associated with AB 32 -- and we understand that you're going to try to minimize the impact on trade-exposed industries including manufacturing hopefully, right now the leakage is happening, even before AB 32 really goes into effect.

We've got energy prices in the region that are far lower than ours. We're at about 9.5 cents per kilowatt hour for industry, and other states in the west are anywhere between 4.5 to 7 cents per kilowatt hour.

So if we're allowing -- it's a little bit like the skids are greased on leakage. And we're not going to get innovation in California. We're simply going to get the expansion happening elsewhere.

So where is the innovation going to happen in terms of at least manufacturing capacity? It's not going to happen in California. It may happen somewhere else because we're -- somebody's having to buy things.

But it won't be us. We'll just be moving manufacturing somewhere else.

I don't have an answer to the problem, but I really do want the innovation to happen here, and I want it to be manufacturing.

Thank you.

DR. BUSCH: Could I ask, Dorothy: Do you have a sense like -- I mean you use site as a sort of assuming capacity is equal across sites, but is there -- do you have a sense of whether there's essentially the same -- is there any variation in size? Because you could have a hundred small sites that would be less capacity than one big site.

MS. ROTHROCK: I've thought about that.

The Site Selection Magazine survey didn't include a reference on the size of these expansions, but I heard from the NFIB yesterday that California really is a small business state.

So in a sense, you might assume that these are probably relatively small expansions because we have so much small business in the state. I guess 90 percent of the business entities in the state are small, whereas 50 percent of the employment is small business.

CHAIRPERSON NICHOLS: Ray?

BOARD MEMBER ROBERTS: Can I interrupt here because there's something I think is being missed here. I think she's hit on it, and it started to come up earlier.

If you look, once -- there's -- the world has changed dramatically, and I think at least some of what

I've heard not is not reflective of that.

At one time I can tell you there were things like research that was done in San Diego. I'm very familiar with the research that was done, for instance, on ballistic missiles. Not only was all the research done, the production was done in San Diego.

That's not happening. And it's not happening in California period.

Let me cite some recent examples.

I mean one that's clear, we have some of the foremost companies in the world developing algae as a fuel. The production facilities, even the research production facilities, will not happen in California.

Why? Because it takes you about two years to get a permit. It's not going to happen. It isn't happening here.

Even the research production facilities are not happening here.

There was once that I think we could count on the innovative people here developing companies that was going to lead to the production here.

That is being separated in a significant way because of the obstacles to doing some of these things in California.

And I think what I've heard out of a lot of

models, there is sort of this smugness that California is going to be innovative, and all these benefits are going to come to California because of this innovation.

I think that our innovative edge is being competed over to a greater extent, and you mentioned all the things you saw in China.

Even the innovation, if we make a new rule, doesn't mean the innovation's going to be in California. But the production and the jobs that you're talking about are on anything of scale -- and by scale, I'm not -- it doesn't have to be very large.

We're talking about research. A pond to grow algae that was going to take over two years to get permitted in San Diego -- in California; excuse me -- in California.

We have some tremendous obstacles, and at the same time we're saying we're going to create all these opportunities.

Those opportunities are going to go elsewhere.

I couldn't disagree more when I'm hearing that somehow that money's going to automatically flow back to California. I think it's absolutely nonsensical.

We are creating a game that in prior years, and maybe in prior decades, we would have had an edge. We would have gotten direct benefits and they would have

been pretty significant.

I don't see it happening now.

And I think some of the questions that you're suggesting and raising need to be looked at in a lot more depth, because the world has changed dramatically.

California needs to really analyze its position, and there's economics that go way beyond anything I've heard today that are at work here that I think suggest that any of these rules may be of benefit and may be of benefit to the planet, but I don't think they're going to be of benefit to California.

CHAIRPERSON NICHOLS: Mr. Williams.

MR. WILLIAMS: Thank you, Chairman Nichols and Members of the Board. I admire you all for your staying power. It's almost 6 o'clock, and you're still very actively engaged. So thank you so much.

My name is Ray Williams from Pacific Gas & Electric. I would just like to lend a perspective on complementary measures and talk for a moment on a price collar.

I'm not a PhD economist, although I did survive a couple of Dr. Wyatt's classes at Stanford in energy economic systems.

There are market failures. Dr. Goulder brought up the renter issue. I know I went and bought a

refrigerator recently. It would have been better to get more information on the cost savings than was available when I made the purchase decision.

So you know, we know it's there. So what are the benefits?

To summarize, they can effectively address market failures where they occur. They can help bring new technologies to market sooner and reduce emissions sooner than without -- than -- if they're designed correctly.

But what are the risks? If they're too preventative, they can choose technologies which are either too costly or just not effective in reducing emissions.

Or they could become more costly. As we found out today, your fuel prices are -- move in a different direction than what we might anticipate.

So given that, I just wanted to suggest a metric for looking at this.

If an allowance price is around $20, let's say, and let's say we have two or three years of experience, and we look at these program measures and, you know, they come in around the range of $20 or less, then you're probably on, you know, you're probably on the right track. Maybe a little more, but moving in that

direction, probably on the right track in terms of design.

But if that program measure is coming in around $100 a metric ton, and we're looking at substantial capital commitments coming in at that time, I think we need to take a closer look at it and, you know, that five-year look in 2012 and 2013 is probably a good time to take a look at that.

So just a metric that you might want to throw out there to tie Cap and Trade and complementary measures together.

CHAIRPERSON NICHOLS: Thank you.

MR. WILLIAMS: Then on the price collar.

The focus, the discourse is generally on the high side, you know, focused on consumer protection and doing it in a way where you still have integrity in the way the cap works. That's very important.

But I also wanted to highlight the floor, a $10 price. That floor price can encourage investment and innovation into the market. It can be something that can be very helpful.

So I just want to position the price collar as kind of a balanced proposal which can help bring innovation into the market as well as help with consumer protection if you don't get the design of this quite

right, particularly in the first or second compliance period.

Thank you.

CHAIRPERSON NICHOLS: Thank you.

The last person who submit a card is Hank DeCarbonel. And then if the lights don't go out, we'll have a few closing remarks.

These are set to go off at 6 o'clock, but we've sent an emissary in the hopes they'll leave them on for us for a while.

MR. DeCARBONEL: I just happened to see an article today in the Financial Times of London regarding the volcanic eruption in Iceland, a stationary source, I suppose. It says:

> Amid mounting pressure from airlines which have been losing an estimated $200 million a day in revenue, European Union transport ministers said they planned to start opening air corridors to bring home some of the hundreds of thousands of people stranded by the disruption.
>
> Giovanni Bisignani --

If you know Mr. Bisignani, I apologize --

> -- head of the International Air

Transport Association, said Europe had a unique system for dealing with volcanic eruptions based on theoretical models on how far ash spreads. The chaos, inconvenience, and economic losses are not theoretical. They are enormous, he said. We must make decisions based on the real situation in the sky. Not on theoretical models.

And I submit that's the problem. It's a wonderful model, but what if somebody's wrong?

We have people standing at hearings in Washington, DC right now. Smartest guys on Wall Street. Smartest regulators and smartest politicians, and they're all competing for how stupid. Each one is dumber than the last.

But in the meantime, we've got an economic collapse in this country, and these guys were all participants. And suddenly, all they can say is they were hornswoggled.

We've got to be very careful here when we start making all these decision on models and theories and what-ifs.

The 3M position is very moderate to me. I think we've got to be very careful what we do and be

very ready to make some quick changes when things don't turn out quite the way we planned.

Thank you.

CHAIRPERSON NICHOLS: Okay. That's closing words of wisdom.

I think I will turn it back over to Larry Goulder, if you have any closing remarks on behalf of the panel. You want to defend the models?

(Laughter)

PROFESSOR GOULDER: No. I think that those last comments were very important.

We have to be humble. I also feel though we want to get all the information we can and make use of it. That's where I think models can contribute.

But we'd be foolish to put more faith in them than the models deserve.

I guess all I would say in closing is thank you. I'm very -- I think it was a very good move. I applaud the ARB for have this session to give the public a chance to look at the differences and results, to contemplate the differences and allow the modelers to try to explain the sources of differences and the range of uncertainties.

So I just want to thank you for letting us participate.

CHAIRPERSON NICHOLS: Well, thank you.

I want to thank the staff who organized this, Jan Mazurek, from my staff. Kevin Kennedy again was sitting at the table. And of course David Kennedy who actually had to do the modeling work here. He's looking an awful lot more rested and dressed up, suited than when I've seen him in recent days.

(Laughter)

CHAIRPERSON NICHOLS: Maybe he's had a little time to relax before coming to the panel. I sure hope so.

These are tough issues, and we're dealing with them in tough times.

And I think the comments and questions coming from all the Board Members indicate that we are very mindful of the importance of what we're doing.

We have both the benefit and the honor of being leaders in California because of our legislation and because of our history, and a lot of confidence has been placed in the Air Resources Board as the agency to do some pretty critical planning and design work.

And we take those obligations very seriously, and we are extremely grateful for the help that we've received, most of it completely uncompensated, from the people on this panel and others over the last years that

we've been working on this.

The next few months are obviously going to be critical times as we try and get ready to come together with the last pieces of our program proposals, including the design of a comprehensive Cap and Trade program.

And this is something that obviously is getting a lot of questioning. We are still hopeful. With every passing day, we get a little less hopeful.

But I think there's still some serious movement in Washington to put another bill forward in the senate and possibly get to a national program. What it will look like, we don't know.

But any decisive movement on the part of the federal government to cap emissions at the national level would be helpful.

We're also actively engaged in working with the Western Climate Initiative. We've had both Mr. Kennedy and Mr. Goldstene attending meetings with the seven western states and three Canadian provinces, and they are going through their own sets of upheavals in the political arena.

And yet still, all of them are at the table working on this issue because, wherever they come from on the political spectrum, they are all facing the recognition that energy independence, a shift to more

renewable forms of energy, are going to be critical to our future if we can find ways to bring them on and to go through a transition as painlessly as possible.

But transitions are always difficult. And so our job is to try to make this one as beneficial as we can and to recognize, as we said -- many people have told us that we don't know everything today that we would like to know.

And so we have to find ways of making progress while at the same time allowing ourselves to make corrections when we need to.

So this is an important fundamental piece of the building blocks for what we're trying to do in California.

All of the modeling work, and despite the occasional jokes, and I may have said a thing or two at times about economists that, you know, wouldn't be entirely flattering. But the fact is --

(Laughter)

CHAIRPERSON NICHOLS: -- that we need you, and we really do appreciate you, and we're going to take advantages of you, what you've given us.

So thank you all very much.

BOARD MEMBER SPERLING: I'd like to follow up on that, just a short comment, and that I also found

this tremendously valuable, the work of the committee.

Professor Goulder, I thought that report summarizing and comparing the report was tremendously value and useful to us.

And I think that an idea possibly as we go forward is perhaps doing something like this again. Chairman Nichols, are you listening?

(Laughter)

CHAIRPERSON NICHOLS: I'm listening. I'm being reminded of all the people I should have thanked.

BOARD MEMBER SPERLING: So I'm actually even taking it one step beyond that, and that is the idea of looking at the policy design a little more.

You know, now that we have some comfort level about the economics of, you know, the whole program, a lot of the issues that came up here in terms of cost containment and, you know, we talked about auctioning offsets, these are very key design elements.

And I for one at least would like to see some kind of forum, something like this with, you know, very expert economists and others to be able to bounce some of these ideas off and get some further input.

And I know Kevin Kennedy is doing a great job doing this. Already he's reassured me on several accounts.

But I think it would be a valuable activity and exercise.

CHAIRPERSON NICHOLS: The staff has indicated that they are going to be, now that we do have the EAAC report and have gotten this forum under our belt, so to speak, that they're going to be opening up a series of workshops on design elements of the program.

And certainly Board Members are going to be encouraged to attend as many of them as they can, as well as stakeholders and other experts that we will invite to come and join us.

So I did fail to mention in the course of patting ARB on the head that we also have a very important partnership within the administration with Cal/EPA.

And they have been taking the lead, the Western Climate Initiative active, and also providing us with significant help along the way. So I did want to acknowledge that and specifically thank Michael Gibbs for his role in this.

Thanks, Michael.

And I have one other thing to say.

When we resume tomorrow morning in the Byron Sher Auditorium, which is our usual home, at 9 a.m., and the first item on the agenda is going to be a staff

update on the implementation of the Scoping Plan as well as their outreach activities.

So this will be a further opportunity to discuss their plans for next steps.

I think that's it. We are adjourned.

* * *

(Thereupon the AIR RESOURCES BOARD hearing adjourned at 6:01 p.m.)

CERTIFICATE OF REPORTER

I, LINDA KAY RIGEL, a Certified Shorthand Reporter of the State of California, do hereby certify:

That I am a disinterested person herein; that the foregoing AIR RESOURCES BOARD meeting was reported in shorthand by me, Linda Kay Rigel, a Certified Shorthand Reporter of the State of California, and thereafter transcribed into typewriting.

I further certify that I am not of counsel or attorney for any of the parties to said meeting nor in any way interested in the outcome of said meeting.

IN WITNESS WHEREOF, I have hereunto set my hand this May 7, 2010.

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